MONTHLY WEATHER REVIEW.

Editor: Prof. CLEVELAND ABBE. Assistant Editor: HERBERT C. HUNTER.

VOL. XXXV. SEPTEMBER, 1907. No. 9.

The MONTHLY WEATHER REVIEW is based on data from about 3500 land stations and many ocean reports from vessels taking the international simultaneous observation at Greenwich noon.

Special acknowledgment is made of the data furnished by the kindness of cooperative observers, and by R. F. Stupart, Esq., Director of the Meteorological Service of the Dominion of Canada; Señor Manuel E. Pastrana, Director of the Central Meteorological and Magnetic Observatory of Mexico; Camilo A. Gonzales, Director-General of Mexican Telegraphs; Capt. I. S. Kimball, General Superintendent of the United States Life-Saving Service; Commandant Francisco S. Chaves, Director of the Meteorological Service of the Azores, Ponta Delgada, St. Michaels, Azores; W. N. Shaw, Esq., Director Meteorological Office, London; Maxwell Hall, Esq., Government Meteorologist, Kingston, Jamaica; Rev. L. Gangoiti, Director of the Meteorological Observatory of Belen College, Havana, Cuba.

As far as practicable the time of the seventy-fifth meridian is used in the text of the MONTHLY WEATHER REVIEW.

Barometric pressures, both at land stations and on ocean vessels, whether station pressures or sea-level pressures, are reduced, or assumed to be reduced, to standard gravity, as well as corrected for all instrumental peculiarities, so that they express pressure in the standard international system of measures, namely, by the height of an equivalent column of mercury at 32° Fahrenheit, under the standard force, i. e., apparent gravity at sea level and latitude 45°.

FORECASTS AND WARNINGS.

By Prof. E. B. GARRIOTT, in charge of Forecast Division.

IN GENERAL.

In September the distribution of atmospheric pressure over the globe undergoes marked changes. The continents of the Northern Hemisphere begin to cool and the flow of atmospheric tides from the oceans to the continents begins. It is a month of increasing storm activity. The West Indian hurricane season is at its height. The latter part of the month usually marks the beginning of the rainy season on the Pacific coast of the United States. Over the Florida Peninsula September generally shows the maximum monthly rainfall of the year.

September, 1907, conformed rather closely to the seasonal average. During the early portion of the month barometric pressure was low over the tropical regions of the Atlantic and eastern Pacific, and averaged high over the more northern parts of the oceans. Over the continents the barometric fluctuations of this portion of the month were frequent, but not marked, and the more severe disturbances were of a local character. The third decade of the month was stormy. Two disturbances of tropical origin advanced from the Gulf of Mexico northeastward, attended by heavy rains and high winds along the Atlantic seaboard, and past eastward over the Atlantic to the British Isles, where barometric pressure continued low after the 23d. The first of these storms apparently moved southeastward from the British Isles and united with a disturbance that had caused exceptionally heavy rains over southwestern Europe. During the early part of this decade the first severe autumnal storm of the season crost the Great Lakes. Following the passage of this storm the first heavy frost of the season occurred in the States of the upper Mississippi and middle Missouri valleys and the western Lake region, and the first light frost of the season in the Ohio Valley and the Middle Atlantic States. On the 15th and 16th the first well-marked storm of the season visited the north Pacific coast.

The following dispatch from Kingstown, Island of St. Vincent, British West Indies, dated September 20, 1907, indicates the character of disturbances that occurred in that section during the prevalence of low barometric pressure over the tropical regions of the oceans:

> Recent advices from the Weather Bureau at Washington were verified in a remarkable manner. A disturbance east of the Windward Islands, which had been announced as probable, developed yesterday into a thunderstorm of great severity. Exceedingly low thunderclouds hung over St. Vincent, and the lightning was fearfully vivid. Several casualties occurred. Similar storms have been experienced in the northern islands.

BOSTON FORECAST DISTRICT.*

[New England.]

The average rainfall exceeded that of any September since 1888. Thunderstorms were unusually prevalent, and were severe in parts of New Hampshire and Vermont on the 11th and 30th, and in Massachusetts on the 21st. Temperature averaged above normal. Killing frost occurred in the interior of Maine on the 19th, and a heavy frost was general, except in coast sections, on the 27th. Heavy rain from the 2d to 5th relieved the severe drought that had prevailed in southern New England during the preceding two months. On the 29th easterly gales caused more or less damage to shipping. Storm warnings were issued on the 23d and 29th, and there were no storms without warnings.—*J. W. Smith, District Forecaster.*

NEW ORLEANS FORECAST DISTRICT.*

[Louisiana, Texas, Oklahoma, and Arkansas.]

The month was unusually warm and dry, and no frost occurred. Storm warnings were displayed on the Louisiana and Mississippi coasts on the 21st and 28th on account of a disturbance in the central Gulf, but no gales occurred on those coasts.—*I. M. Cline, District Forecaster.*

LOUISVILLE FORECAST DISTRICT.*

[Kentucky and Tennessee.]

Temperature was, on the whole, seasonable, and rainfall was below the normal, except in eastern Tennessee, where heavy rain fell on the 21st and 22d. The first light frost of the season occurred over a large portion of Kentucky on the 26th. Hailstorms caused considerable damage in Kentucky on the 2d and 7th.—*F. J. Walz, District Forecaster.*

CHICAGO FORECAST DISTRICT.*

[Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas, and Montana.]

Two storms of moderate energy crost the Lake region during the third decade of the month. Warnings were ordered well in advance of these storms, and no damage to shipping was reported. Frost occurred in the Northwest early in the month. The coldest weather of the month attended an area of high barometer that appeared on the northeastern Rocky Mountain slope on the morning of the 24th. By the morning of the 25th the frost line had extended southward to central Illinois

and eastward to Lake Michigan, and by the following morning had covered the entire eastern section of the district. Warnings were ordered in advance of this condition in nearly all States threatened, with the exception of the central sections on the 25th. Local frosts occurred in the cranberry marshes of Wisconsin on several dates, and special warnings were issued in every case in advance of them.—*H. J. Cox, Professor and District Forecaster.*

DENVER FORECAST DISTRICT.*

[Wyoming, Colorado, Utah, New Mexico, and Arizona.]

The month presented no marked abnormal features. There was less than the average amount of precipitation generally thruout the district, and in Utah the mean temperature was somewhat below normal. Frost was confined to central and northern portions of the district, and at moderate elevations was generally light. Accurate and timely warnings were issued of frost that occurred in agricultural sections.—*F. H. Brandenburg, District Forecaster.*

SAN FRANCISCO FORECAST DISTRICT.†

[California and Nevada.]

The month was unusually cool in the Sacramento and San Joaquin valleys. Light rains occurred along the coast and showers and thunderstorms in the Sierra and Nevada on the 3d, 4th, and 5th. Light rain fell in the extreme northern portion of California on the 17th, 24th, and 27th, and light snow in the Sierra on the 28th. No frost or storm warnings were issued.—*G. H. Willson, Local Forecaster.*

PORTLAND, OREG., FORECAST DISTRICT.†

[Oregon, Washington, and Idaho.]

The month was unusually quiet and temperature and rainfall were nearly normal. Storm warnings were ordered on two dates for minor disturbances, and all frosts were successfully forecast.—*E. A. Beals, District Forecaster.*

RIVERS AND FLOODS.

There was little of interest during the month, and no floods occurred, except along the lower portion of the James River, in which the stages reached exceeded the flood line. Warnings were issued for the Ocmulgee and Oconee rivers in Georgia, the Wateree River in South Carolina, the James River in Virginia, and for the Binghamton district in New York.

No damage has been reported, except from the Binghamton district where the excessive rains caused washouts in the railroad beds and flooding by backwater from the sewers.

The highest and lowest water, mean stage, and monthly range at 202 river stations are given in Table VI. Hydrographs for typical points on seven principal rivers are shown on Chart I. The stations selected for charting are Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.—*H. C. Frankenfield, Professor of Meteorology.*

* Morning forecasts only; night forecasts made at Washington.
† Morning and night forecasts.

SPECIAL ARTICLES, NOTES, AND EXTRACTS.

ON ATMOSPHERIC CURRENTS AT VERY GREAT ALTITUDES.

By Prof. C. C. TROWBRIDGE. Contributed from the Phoenix Physical Laboratory, Columbia University, New York, N. Y., September 5, 1907.

In a recent abstract[1] the writer gave a brief summary of the results of a study of the luminous and long-enduring streaks or trains which are occasionally formed by large meteors. A complete discussion of the physical nature of these trains, with some additional facts recently determined, will appear shortly in the Astrophysical Journal.[2] The present paper relates to the atmospheric currents which are shown to exist in the extreme upper regions of the atmosphere of the earth by the observed drifting of these luminous trains.

The systematic observation and study of meteor trains is of much importance to meteorology because it is the only means by which the presence as well as the direction and velocity of atmospheric currents at very great altitudes above the surface of the earth can be determined. There has been little, if any, systematic work done in this direction heretofore. It is possible that one of the chief reasons for this fact is that the observations of meteor trains have been made almost entirely by astronomers, often in an incidental manner when engaged in other work; while the results obtained relating to the atmosphere and principally of interest to meteorologists have been published in astronomical journals and hence overlookt by those most interested in the subject.

Meteor trains are apparently self-luminous clouds which are usually deposited by large meteors, and particularly those that are swift moving, like the Leonids and Perseids. Astronomers who have made frequent meteor observations are familiar with the phenomenon, but few have taken up the matter further than to make records of the trains which they have seen. There are some notable exceptions. E. E. Barnard is the author of a paper entitled "Drifting meteor trains",[3] in which he gave the directions and rates of drift of five trains seen at Nashville, Tenn., having southeasterly and northeasterly drifts, and called attention to the importance of the observation of meteor-train drifts as a means of studying the movements of the atmosphere. W. F. Denning and A. S. Herschel have referred on many occasions to the drifts in England, and in a number of cases have calculated the altitude and in some the rate of drift of trains. H. A. Newton, C. A. Young, E. E. Barnard, and others have reported them in the United States from time to time. The astronomical journals contain records of train observations made in various countries all over the world.

The study of meteor trains was undertaken by the writer in order to find an explanation of the mysterious persistent luminosity of trains seen at night in the light of recent advances in physics, particularly relating to the conduction of electricity in gases, recombination of the gaseous ions, etc., and a solution of this problem seems promising. In the course of the work there has been found much valuable material relating to the movements of the upper currents in our atmosphere, which is brought together in the present paper.

Many of the trains studied are those which occurred from 1860 to 1870, when meteor observations were more numerous than usual, owing to the interest in the great Leonid showers of 1866, 1867, and 1868, but some of the most important records are of recent date. A number of bright trains were seen during the Leonid shower of 1901. In working up the records it was frequently necessary to determine the direction of the atmospheric drifts by reference to a celestial globe, for in many cases the movements of the trains with respect only to stars were found in the records.

The train drifts given in the present paper do not represent all the recorded observations on the subject, for, owing to the magnitude of the work, it has been possible for the writer to cover only a portion of the field, and the conclusions drawn are thus necessarily based on but a part of the available material. However, over sixty observations of meteor-train drifts have been found. These are given in Tables

[1] Physical Review, June, 1907, p. 524.
[2] Astrophysical Journal, XXVI, 2, Sept., 1907.
[3] Sidereal Messenger, I, 174, 1883; reprinted in 1891.

1–5. In order to retain the units used in the original records, the writer has exprest the altitude of trains and velocity of drift, in most cases, in miles rather than kilometers. The observations, when tabulated and studied, appear to bring out some new conclusions concerning the movements of the atmosphere at great altitudes. When further observations are made, and also all the past records are carefully studied, additional results will certainly be derived.

TABLE 1.—*Meteor-train drifts observed in Great Britain on November 14, 1866.*

No.	Place.	Time.	Drift toward—	Remarks.
9	Glasgow Observ'ry	12:32:50 a. m	S.	Visible about 5 minutes.
10*	Glasgow Observ'ry	12:40 a. m	E. by S.	Visible about 8 minutes.
11	London	1:07 a. m.	NW. by W.	5° in 10 minutes.
12	Cardiff	1:08 a. m.	E.	Several accounts.
14	Bath	1:50 a. m.	E. or SE.	
16†	Nottingham	2:12 a. m.	SW.?	"Drifted slowly along in a southwest current."
17	Kent	2:12:30 a. m.	S.	Visible 6 minutes.
18	Glasgow Observ'ry	2:14 a. m.	S.	
22	Kent	2:20 a. m.	E.	Slightly eastward.
26	Edinburgh, etc.	2:40 a. m.	SE.	Train 61 to 67 miles altitude. Drifted 30° in 15 minutes.

* 50 miles altitude.
† A southwest current, in ordinary nautical phrase, drifts toward the southwest, but a southwest wind drifts toward the northeast.—EDITOR.

TABLE 2.—*Meteor-train drifts observed at various dates in Great Britain.*

No.	Place.	Date and hour.	Drift toward—	Remarks.
1	London	July 16, 1861, 11:30 p. m	S.	15° to 20° in 5 minutes.
62	England	Nov. 13, 1866, 2:14 a. m.	SE.	Drifted 30°.
42	Birmingham	Aug. 11, 1868. 12:08 a. m	SE.	
39	Southampton	Jan. 1, 1868, 1:27 a. m.	E.	
93	Dunbar	Aug. 15, 1870, 8:50 p. m.	SW.	Three accounts.
57*	Walesand Scotland	Nov. 6, 1869, 6:50 p. m.	NE.	Train from 45 to 27 miles altitude.
79	England	Oct. 30, 1891, 9:13 p. m.	NNE.	1° in 25 seconds.
80	Bridgewater, etc.	Aug. 26, 1894, 10:20 p. m	SE.	122 miles per hour at 54 miles altitude.
110†	Bristol	Oct. 27, 1900, 11:42 p. m.	SSE.	Visible for 13 minutes.
121*	Southampton	Jan. 7, 1856, 4:51 p. m.	SE.	Visible for 10 minutes.
67*	Torquay	Nov. 6, 1869, 6:45 p. m.	NE.	

* Train illuminated by sunlight. † Drifted 10° in 10 minutes.

TABLE 3.—*Meteor-train drifts observed at various dates and places.*

No.	Place.	Date and hour.	Drift toward—	Remarks.
86	Paris	Aug. 13, 1899, 12:53 a. m	SW.	14° in 20 minutes.
31*	Paris	June 13, 1867, 8:00 p. m	W.	Altitude 85 to 65 miles. Two observations.
30*	India, lat. 19° 55′ N.; long. 74° 55′ E.	Nov. 14, 1866	W.	Late in the evening.
97*	Asia Minor	June 18, 1845	W.	In twilight.
82	South Africa	Oct. 22, 1895, midnight	Upper S. / Lower N.	Visible ½ hour.
128*	Tondern, Ger	Sept. 28, 1878, 7:30 p. m.	W.	Visible 1½ hours.

* Probably illuminated by sunlight.

TABLE 4.—*Meteor-train drifts observed in the United States during the Leonid showers of 1866, 1867, and 1868.*

No.	Place.	Date and hour.	Drift toward—	Remarks.
29	New Haven, Conn.	Nov. 14, 1866, 2:11 a. m.	N.	125 miles per hour, 60 miles altitude; 3 stations.
32	Dartmouth, N. H.	Nov. 14, 1866, 1:57 a. m.	NW.	Visible 6 minutes.
33	Iowa City, Iowa	Nov. 14, 1867, 2:51 a. m.	SE.	7° in 4 minutes.
34	....do.	Nov. 14, 1867, 2:56 a. m.	SE.	2° in 3 minutes.
35	....do.	Nov. 14, 1867, 3:03 a. m.	SE.	1½° in 3 minutes.
36	....do.	Nov. 14, 1867, 3:08 a. m.	S. by E.	11° in all.
36a	....do.	Nov. 14, 1867, 3:08 a. m.	S. by E.	Time shortly after 3:08 a. m.
37	New Haven, Conn.	Nov. 14, 1867, 4:. . a. m	E.	2° or 3° in 4 minutes.
38	Washington, D. C.	Nov. 14, 1867, 4:07:20 a. m.	N.	
44	New Haven, Conn.	Nov. 14, 1868, 1:12 a. m.	N. above 50 miles, S. at 50 miles	South drift 60 miles per hour.
48	Marathon, N. Y.	Nov. 14, 1868, 3:. . a. m.	N.	Visible several minutes.
49	Brunswick, Me.	Nov. 14, 1868, 3.51:30 a. m.	N.	Doubly observed.
50	New Haven, Conn.	Nov. 14, 1868, 5:06:45 a. m.	Upper S. / Lower N.	Northward movement about 40 miles in all.
51	Bloomington, Ind.	Nov. 14, 1868, 5:25 a. m.	E.	Visible 10 minutes; drifted slowly.
52	Boston, Mass.	Nov. 14, 1868, 5:30 a. m.	N.	Altitude 59 miles.

TABLE 5.—*Meteor-train drifts observed in North America before 1866 and after 1868.*

No.	Place.	Date and hour.	Drift toward—	Remarks.
7	New Haven, Conn.	Nov. 13, 1865, 4:. . a. m.	N.	North of zenith.
8	....do.	....do.	N.	South of zenith.
55*	Pennsylvania or New York.	Aug. 24, 1869	W.	Early evening.
56*	....do.	Aug. 24, 1869, 7:25 p. m.	W.	Early evening.
61	Florida	Aug. 14, 1869	N.	Early morning.
67	Dubuque, Iowa	Aug. 23, 1878, 10:50 p. m	E.	
73	Dakota	Oct. 4, 1882, 7:50 p. m	SW. or S.	Two accounts.
78*	Arizona	July 9, 1882, 7:50 p. m.	W.	Visible 10 minutes.
111†	Nashville, Tenn.	Nov. 16, 1881, 7:. . p. m.	NE.	4° in 15 minutes.
112†	....do.	Aug. 9, 1882, 9:. . p. m.	SE.	1° in 2 minutes.
113†	....do.	Aug. 12, 1882, 3:. . a. m.	SE.	1° in 1 minute, 10 seconds.
114†	....do.	Aug. 18, 1882, 10:30 p. m	NE.	1° in 3 minutes, 15 seconds.
115†	....do.	Aug. 19, 1882, 1:30 a. m	E.	1° in 32 seconds.
95†	....do.	May 7, 1883, 3:10 a. m.	E. by S.	1° in 37 seconds.
75	Branch Co., Mich	Jan. 3, 1883, 7:00 p. m.	E.	
81	Chicago, Ill	Nov. 15, 1893, 2:50 a. m.	E.	7° in 30 minutes.
87	Boston, Mass.	Nov. 14, 1901, 5:09 a. m.	NE.	2° in 15 minutes.
88†	Chicago, Ill	Nov. 14, 1901, 2:59 a. m.	E. or NE.	Two stations; 5° in 16 minutes.
90	South California	Nov. 15, 1901, 3:30 a. m.	N. by W.	
98	N. W. Ter., Canada	Nov. 15, 1901, 4:. . a. m.	N.	

* Train illuminated by sunlight. † Trains observed by E. E. Barnard.

The subjects discust in the present paper are arranged under the following seven chapters:

I. The meteor-train zone.
II. Superimposed air currents at great altitudes.
III. Probable connection between latitude and the predominating drift in the meteor-train zone.
IV. Explanation of illustrations, figs. 1–7.
V. Slow rate of fall of meteor trains.
VI. Meteor trains and laboratory experiments.
VII. Systematic observation of meteor trains.

I.—THE METEOR-TRAIN ZONE.

The altitude above the surface of the earth at which meteor trains occur when seen at night is between about 45 and 65 miles (72–104 kilometers). The height most favorable for longest visible duration appears to be about 55 miles (88 kilometers). Thirteen trains in the writer's catalog, carefully observed at two or more stations and their altitudes determined by triangulation by well-known astronomers, give a height of 54 miles for the mean altitude of the middle portions of the trains. It is the opinion of the writer that the density of the atmosphere prevailing at the altitude mentioned is favorable both for the formation and for the long duration of the persistent train. It would seem appropriate to call the region where these persistent luminous streaks of meteors seen at night occur, *the meteor-train zone.*

Trains of meteors which fall in daylight or twilight are not infrequently seen. They are apparently thin smoke trains illuminated by the light of the sun, and according to measurements occur as low as 25 miles altitude, but seldom above 50 miles, or between 40 and 80 kilometers. The trains seen at night, however, are usually, if not always, above 45 miles. It is thus seen that meteor trains occur at an altitude that is far above the regions which we are ordinarily familiar with. Various other means have been utilized to gain knowledge of the earth's atmosphere at considerable altitudes. As is well known, much has been accomplished recently by cloud observations and by means of kites and balloons provided with recording apparatus. The heights from which observations have been obtained by these means are as follows: The limit to which kites can be raised is about 4 miles, and while cloud observations have been made to a height of 8 miles, the usual region for cloud study is below this level; in a few cases, so-called ice clouds have been observed at considerably higher altitudes.[4] Balloons with recording meteorological apparatus have been sent to an altitude of about 15 miles, or 24 kilometers, but the usual limit for successful operation is below 12 miles, or 19 kilometers.

[4] The nocti-lucent clouds of midsummer are computed to be at 15 to 30 miles altitude.—EDITOR.

The distribution of volcanic dust over the earth's surface by air currents has served as a means of giving information concerning atmospheric drifts at altitudes of 25 and perhaps 30 miles, in but one notable instance only; i. e., the well-known facts of the drift of the volcanic dust of Krakatoa following the eruption of that volcano on August 26, 1883, from which it was concluded that at the equator there was a current in the upper atmosphere of from 70 to 80 miles per hour toward the west (the mean rate being 73 miles, or 117.4 kilometers), and at an altitude estimated to be about 25 miles, or 40 kilometers, above the earth's surface. This current was detected by the progressive change in the color of the sun as seen from different stations around the earth. The sun appeared bluish wherever it was partially screened by the thin cloud of volcanic dust [5] suspended in the atmosphere.

Summary of the observations in Tables 1–5.

The sixty-two meteor trains in Tables 1–5, observed chiefly in Great Britain and in the United States, show the directions of drift summarized below.

Trains seen at night.		Trains seen in daylight or twilight.	
Drift toward—	No. cases.	Drift toward—	No. cases.
North	10	North	0
Northeast	4	Northeast	1
East	12	East	0
Southeast	12	Southeast	1
South	6	South	0
Southwest	4	Southwest	0
West	0	West	7
Northwest	2	Northwest	0
Drift in two strata in different directions	3		
Total	53	Total	9

In 26 of these observations the rate of drift in degrees or miles was recorded. The greatest velocities observed were as follows:

In one case, 125 miles (200 kilometers) per hour northward drift, at over 60 miles (96.5 kilometers) altitude above New England, in the United States; and in another, 61 miles in 30 minutes, or 122 miles (196 kilometers) per hour, southeastward drift, at 54 miles (86.8 kilometers) altitude above England. Such rapid drifts appear to be not uncommon. In many cases the drift in degees was recorded, and if one degree is considered as equivalent to not less than one mile, as it would be for a drifting train at a distance of 57 miles, which is a conservative estimate, it is seen that a number of trains drifted in a current moving at a velocity of over 100 miles (160 kilometers) per hour.

It has been generally supposed that at great altitudes above the surface of the earth in the Northern Hemisphere there is an eastward drift, as has been suggested by Barnard. Among the facts demonstrated by this comparative study of meteor-train drifts are the following: First, that the drift toward the east predominates, which in the main is a confirmation of Barnard's view; and second, that the drift at altitudes of from 50 to 65 miles may be in any direction in northern United States and in England, and perhaps in the entire North Temperate Zone. That air currents may be in any direction at these great altitudes would seem to be an important fact bearing on the circulation of the earth's atmosphere, and also on the relation of currents in the meteor-train zone with those below.

It is a curious fact concerning the drift of nine daylight trains, or those seen by the reflected light of the sun, that seven were recorded as carried in a current toward the west, while none of those seen at night showed a westward drift; four of the latter, however, were southwest and two northwest. Owing to the fewness of the observations it is scarcely safe to draw any conclusions from this apparent westward drift, which probably took place in most cases in strata below an altitude of 50 miles. Moreover, the drift of meteor trains when noted by one observer can be recorded only with approximation, since merely one projection of the drift against the sky can be seen. A large number of such observations at different stations, however, when tabulated and studied would surely indicate some significant fact.

[5] This "dust" may have been minute spheres of vapor or ice.—EDITOR.

II.—SUPERIMPOSED AIR CURRENTS AT GREAT ALTITUDES.

There is almost conclusive evidence that there are at all times in the upper atmosphere superimposed currents of different velocities; usually those adjacent are in different directions in zones of from 5 to 10 miles in depth; in some cases in one zone there will be almost a calm, while directly above or below it there will be a current of considerable velocity.

It is the writer's opinion that there are always a number of these superimposed atmospheric strata with drifts in different directions. Many descriptions of trains record the appearance of several bends in the train, often referred to as "M's" and "N's" gradually formed after the train has lasted for some minutes. The arms (the straight parts of the letters), which correspond to the distances between bends in the train, are miles in extent; hence these curious distortions in the trains can arise from but one cause: namely, the variation in the velocity or direction of the currents of the atmosphere at different altitudes. In the case of one train, observed by H. A. Newton, three different drifts were recorded in opposite directions, one above the other, and in a number of others seen by various observers two drifts in opposite direction, all within ten miles difference in altitude; hence it is quite apparent that the higher atmosphere consists of a number of superimposed strata moving in different directions with various velocities. A typical train showing the forms described is that shown in fig. 3.

These superimposed currents may arise from differences in temperature perhaps due to the differences in radiation thruout the atmosphere, or they may accompany storms and the changes of atmospheric pressure near the surface of the earth. The same forces must be present in the upper atmosphere that are active near the surface of the earth. It would seem probable therefore that there are gradients of pressure, and hence unstable conditions, at various levels up to a height of 60 miles, sufficient to account for the observed movements in different strata at these great altitudes. The upper drifts would be thus similar to the well-known superimposed air currents in different directions near the earth. The fact that there are currents of high velocity in the upper atmosphere, and so often in different directions and probably changing in level, serves as good evidence that the composition of the atmosphere must be quite uniform up to heights corresponding to very low gas pressures.

III.—PROBABLE CONNECTION BETWEEN LATITUDE AND THE PREDOMINATING DRIFT IN THE METEOR-TRAIN ZONE.

Of 21 separate observations of the drift of trains in England and Scotland, in Tables 1 and 2, 15 show the presence of a current toward the southeast quarter of the compass, either east, southeast, or south; and on different dates 7 out of 12 drifts were southward or southeastward. But in the United States, 21 observations out of 32, in Tables 4 and 5, show a drift toward the northeast quarter of the compass, either north, northeast, or east; and on different dates or in widely different localities 13 out of 22 drifts were northward or northeastward. Of course, there are several questionable cases which might change these figures slightly, but the facts seem to indicate a difference in the drift of the atmosphere at about 55 miles height due to difference in latitude. Three daylight trains in Tables 4 and 5 were omitted in the above figures.

On November 14, 1866, in England and Scotland, the meteor-train zone current was directed toward the south or southeast

as shown by 6 or 7 out of 10 observations. On November 15, 1901, the drift in the western part of the United States appeared to be northward, while on November 14 in the middle and eastern portion it was toward the northeast.

While at present the observations are perhaps insufficient to show definitely a connection between latitude and the predominating atmospheric current in the meteor-train zone, yet the facts just mentioned seem to indicate that, passing northward thru the North Temperate Zone, the predominating current in the atmosphere at between 50 and 60 miles altitude is first northward, then northeastward, and finally, when latitude 50° to 60° is reached, southeastward. It seems not unlikely that the predominating drift may be partially dependent on local conditions which arise from the relative positions of continent and ocean in certain regions.

IV.—EXPLANATION OF ILLUSTRATIONS.

Caution must be exercised in the study of meteor-train drawings, because the pictures are necessarily often made hastily, and since trains from different view points may appear very different, owing to foreshortening; in many cases, however, it is evident that trains have been drawn with care.

Several drawings have been selected from a large number which show some interesting facts and in which also the foreshortening effects appear to be a minimum. In some of the illustrations the writer has added dotted lines and arrows to show the indicated atmospheric currents. Very exact copies of the original illustrations have not been attempted, but the drawings are as accurate as such sketches can be and serve their purpose perfectly.

The first of these drawings is fig. 1, *a*, *b*, *c*, *d*, a train seen by H. M. Dole, November 14, 1901, at 5:09 a. m., at Jamaica Plain (Boston), Mass. (No. 87 in Table 5). This drawing was sent to the writer by the observer. A similar illustration appears in Popular Astronomy, January, 1902. The northeasterly drift was apparently about 12 miles per hour, and the diffusion rate well observed. The train gradually expanded to 1.5° in width. The large size of the train is demonstrated by comparison with the familiar stars of Ursa Major which appear in the drawing. The train was visible about a quarter of an hour, and it is obvious that its exact position could readily be determined. The same train was observed at the Ladd Observatory, Providence, R. I., but its altitude has not been calculated.

Fig. 2 shows how rapidly a straight meteor train is distorted by atmospheric currents. These trains are many miles in length and hence the changes in form observed must not be accounted for by eddy currents which are set up by the rapid flight of the meteor thru the air. Eddy currents probably occur, but their sphere of influence can not exceed 100 or 200 meters. The train shown in fig. 2 was observed at Sidmouth and Cardiff, England, November 14, 1866, at 1:08 a. m., and was visible ten minutes (No. 12 in Table 1). The drawings appeared in the Reports of the British Association for the Advancement of Science, 1867, page 313.

Fig. 3 is a drawing of a meteor train seen over the Persian Gulf from Cape Jask, June 8, 1883, at 7:51 p. m. and observed by H. Harrison (not included in the tables). The drawing is taken from The Observatory.[6] The meteor fell vertically and it is evident that the changes in the form of the train noted at 7:57 and 8 o'clock are due to currents in nearly opposite directions in the atmosphere. The writer has added arrows and dotted lines to indicate the atmospheric movements. There were evidently in this case four superimposed currents, indicated in the drawing by small arrows, but the relative positions of the superimposed layers is somewhat uncertain from the illustration.

In fig. 4 the train shows two facts; first, the current in the atmosphere near the upper end of the train was very rapid, and second, below the sharp bend in the train there was a zone of comparative calm, at least in a direction perpendicular to the line of vision of the observer, then below this zone was a wind in the same direction as the one above. This meteor-train (No. 26 in Table 1) was observed by Backhouse at Sunderland, England, November 14, 1866, and is shown as it appeared at 2:42 a. m.[7] The meteor was seen at 2:40 a. m. from Edinburgh and Newcastle-upon-Tyne.

When trains appear broken like a straight staff bent over, similar to the train shown in fig. 4, or broken off, it is good evidence that at the level where the break occurs is the beginning of a zone in which there is a rapid current. Frequently a portion of the train will be observed to become detached and move off a number of degrees from the remaining portion of the train. Such a train was observed by Larkin in 1901 in California; the upper portion of it separated from and drifted some ten degrees from the lower. Fig. 5 shows a train which drifted in the same direction as the meteor's flight—*A*, as it first appeared; *B*, a few minutes later (No. 17 in Table 1).

Fig. 6 is a train carefully observed and discust at length by the late Prof. H. A. Newton of Yale, who carefully measured the height and drift of the train. The drawing is taken from the American Journal of Science, Vol. XLVII, page 399, Plate I. The train was visible forty-four minutes, and was 30 miles long at first, at a mean altitude of 54 miles, extending from 59 to 49 miles. The meteor was a Leonid observed at 1:12 a. m., November 14, 1868 (No. 44 in Table 4). At 1:14:10 the train was very distinct, but stars were seen thru it and it appeared as in (1). At 1:18:10 it appeared as in (2), moving sluggishly, and lookt like the nebula in Orion in a 12-inch glass. At 1:21:30 it was still a striking object, appearing as in (3). At 1:28 it had changed to the form of (4). According to Newton, the train had an appreciable breadth at first of about twenty minutes of arc, corresponding to a diameter of 1 mile, and the diameter was steadily increasing.

Newton's description of the drift (American Journal of Science, XLVII, 1869, page 408) is as follows:

> The southward motion of the lower end at Haverford, 80 miles from the cloud, was 25°, and at New Haven, 175 miles distant, was 8° or 10° during two-thirds of the period of visibility. These imply a motion of at least 40 miles, or about a mile per minute.
>
> We must therefore assume that just below an elevation of about 50 miles, there was a rapid north wind, which swept the lower portion of this cloud with it southward The wind may have come from one or two points east of north. Above this there was a south wind (or south-southeast), whose velocity may have equaled that of the lower north wind, tho it may also have been much less.
>
> By its downward motion the eastern end of the cloud was carried from the upper current into the lower, and strewn along into the horizontal cloud, seen at New Haven in the latter part of the period of visibility.

In closing his paper relating to this remarkable meteor, Professor Newton remarks: "What kind of matter it is which remains visible in cold upper air for three-fourths of an hour, until by gradual dissipation the light fades out, I leave for others to say." In his opinion the wavy motion and coiling of the train was due to the eddies produced by the rush of the meteor thru the air.

In fig. 7 a drawing of a train is shown which was sent to the writer by W. F. Denning of Bristol, England. The meteor appeared October 27, 1900, at 11:42 p. m. (No. 110 in Table 2). The train was visible thirteen minutes by using an opera glass. This train was selected to show how instantaneously the train assumes the motion of the atmosphere, the drift being almost at right-angles to the meteor's flight. Numerous similar cases have been reported.

V.—SLOW RATE OF FALL OF METEOR TRAINS.

It is evident that meteor trains fall but little owing to gravitational force, even assuming that they are partly composed of fine meteoric dust. This is shown by the calculations

[6] Vol. VI, 1883, p. 271.

[7] Report of the Luminous Meteor Committee, in the Report of the British Association for the Advancement of Science, 1867, p. 377.

Train of November 14, 1901, showing rapid expansion.

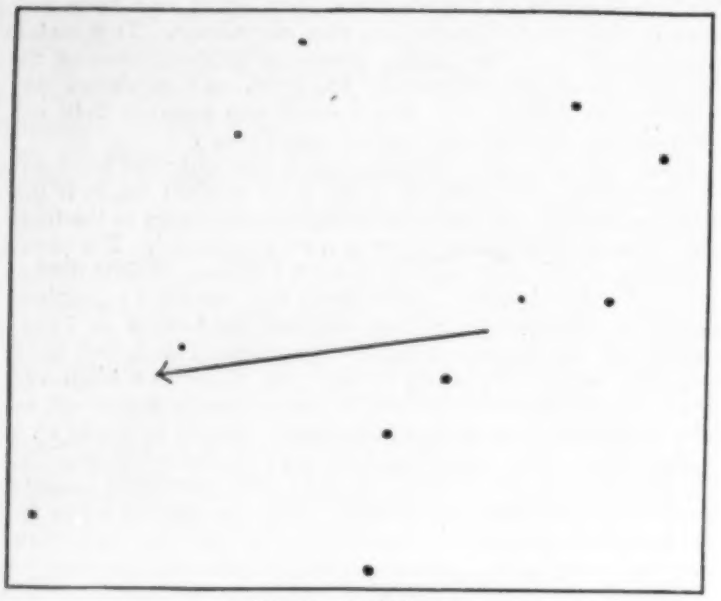

FIG. 1 *a*, at 5:09 a. m.

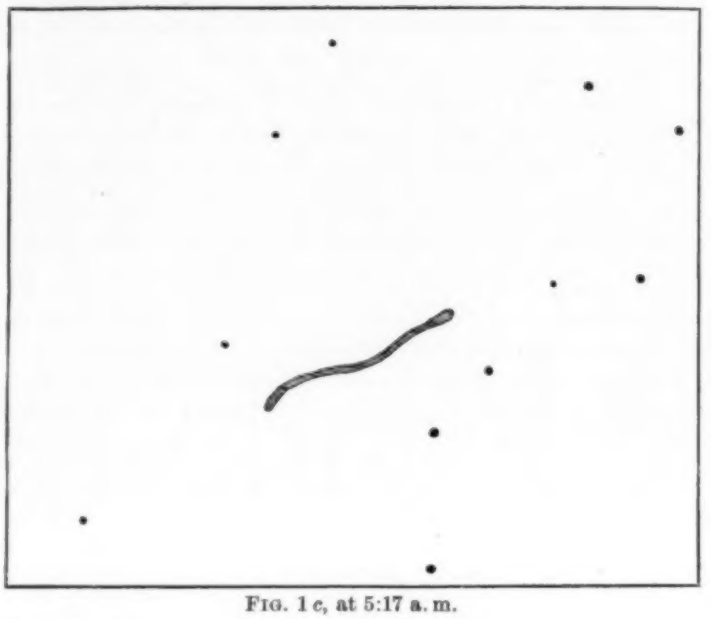

FIG. 1 *c*, at 5:17 a. m.

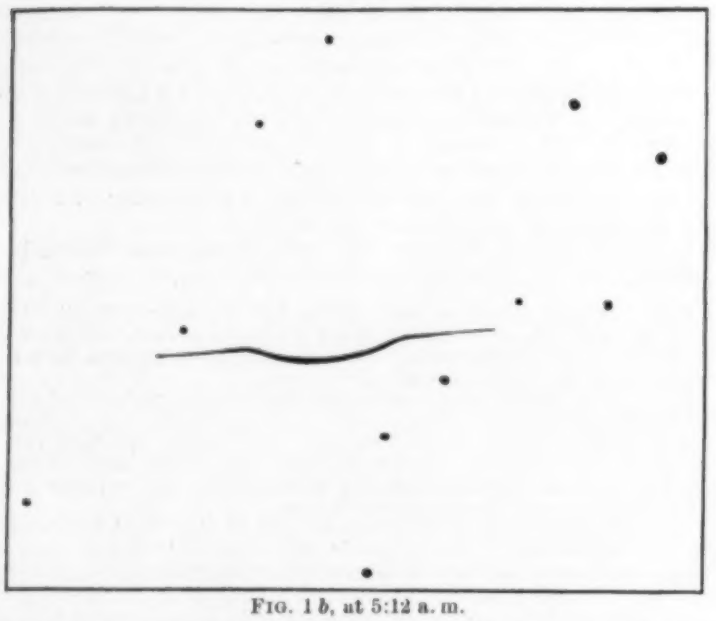

FIG. 1 *b*, at 5:12 a. m.

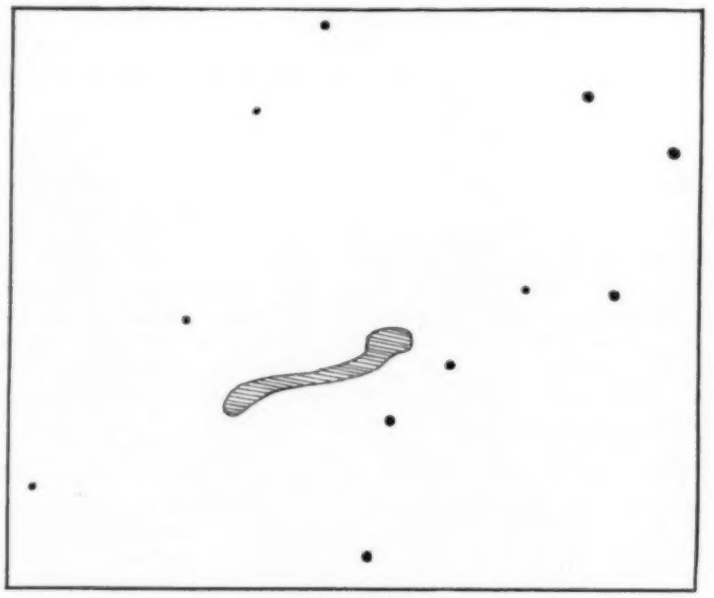

FIG. 1 *d*, at 5:25 a. m.

which have been made of the rate of fall of volcanic dust which drifted in the atmosphere after the eruption of Krakatoa in 1883. The Krakatoa Committee, appointed by the Royal Society of Great Britain, using a formula of Stokes, found that at an altitude of 15 miles particles .00003 inch (or .000075 centimeter) in diameter would fall at the very slow rate of 47 feet (15 meters) per day, a velocity agreeing approximately with the results of experiments performed by Professor Kiessling.[8] The solid particles of the meteor trains can certainly be no larger and are probably smaller than .00003 inch in diameter. While allowance must be made for the great altitude of the meteor train and the low density of the air, it should also be remembered that a descent of the luminous meteoric cloud, at even 16,000 times the above velocity or about the rate of 1 mile in ten minutes, would scarcely be observable. Moreover, the most carefully and longest observed trains have shown no descent, with one exception, that mentioned by Newton; therefore, if there is a downward movement observed in the case of any meteor train it must be due to a descending air current, and any descent due to gravitational force must be negligible. Trains can be safely regarded for meteorological purposes as clouds of gas or vapor, which change their positions and shapes by reason of their drift in the atmosphere, and increase in size by gas diffusion.

[8] The Eruption of Krakatoa, etc., p. 451.

VI.—METEOR TRAINS AND LABORATORY EXPERIMENTS.

Meteor trains seen at night are evidently self-luminous and are sometimes very bright, far too bright to be due to reflected light. They apparently have a spectrum that is composed of lines or narrow bands which indicates that they shine by their own light, and they are also considered self-luminous by astronomers who have observed them. The writer has been endeavoring to determine if the gas phosphorescence shown as the "afterglow" produced in a vacuum tube by the electrodeless ring discharge is the same phenomenon as the long-enduring train formed by meteors. Some interesting facts concerning this afterglow have already been determined. Some of these which relate to the present subject are very briefly stated as follows:

1. Experiments by the writer have resulted in the determin-

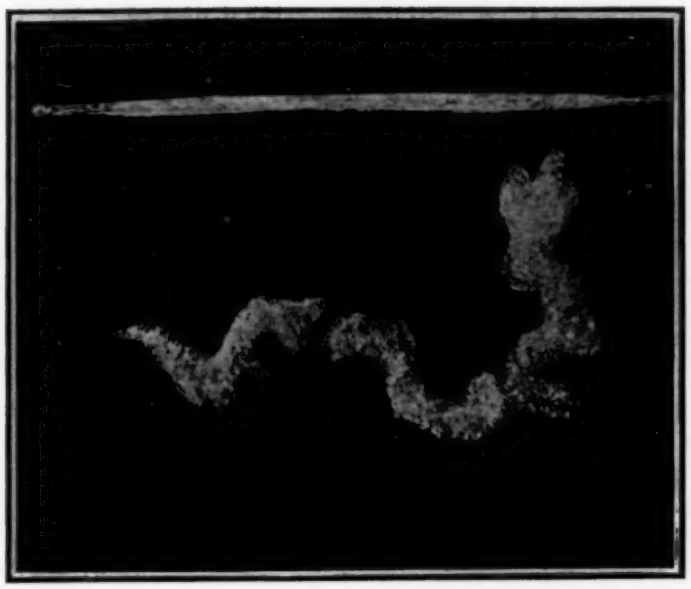

FIG. 2.—Train of November 14, 1866, 1:08 a. m., showing rapid distortions by air currents.

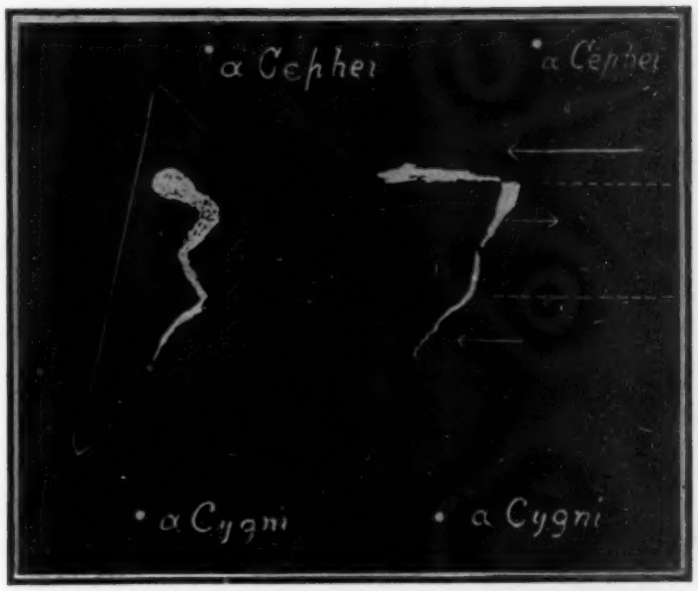

FIG. 4.—Train of November 14, 1866, 2:40 a. m., showing rapid current at the level of the upper portion of the train.

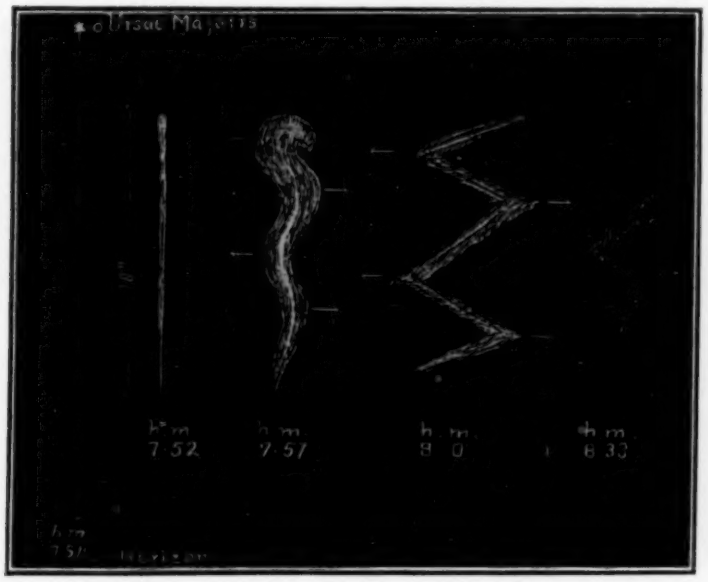

FIG. 3.—Train seen over the Persian Gulf, June 8, 1883, 7:51 p. m., showing the effect of currents in different directions at different altitudes.

FIG. 5.—Train of November 14, 1866, 2:12:30 a. m., showing drift in same direction as flight of meteor.

ation of the law of decay or fading away of the afterglow in air at very low gas pressures. If the meteor train is a gas phosphorescence, which seems very likely, then its long-enduring luminosity is readily explained by applying that law to the fading light of the meteor train.

2. A study of the duration of the afterglow at various pressures shows that it occurs at a maximum at about 0.1 millimeter gas pressure, therefore, it is possible that pressures of the atmosphere at 55 miles above the earth may be not far from this value.

3. The color of meteor trains seen at night is usually yellow, green, or white. Twelve out of 27 proved to be green. The afterglow in the air is greenish yellow.

4. Meteor trains diffuse outward from the meteor track at a mean rate of about 100 meters per minute. The afterglow also diffuses with a velocity of the same order. Since diffusion is dependent on gas pressure and temperature, an experimental study of the subject may result in finding an approximate value for the pressure and temperature of the atmosphere where meteor trains are formed. While the evidence is by no means conclusive that meteor trains are the same as the afterglow produced in a vacuum tube, yet there are many points common to the two phenomena.

VII.—SYSTEMATIC OBSERVATIONS OF METEOR TRAINS.

It would appear as if the study of air currents at great altitudes was of sufficient importance to make worth while the inauguration of some plan for the systematic observation of meteor trains.

If, at a number of the observatories, watches are kept thruout the night at the times of the Perseid and Leonid showers,

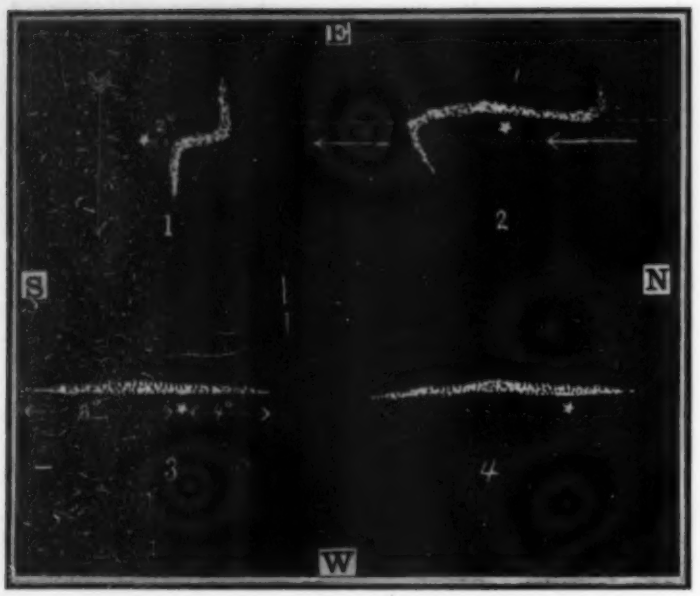

FIG. 6.—Train of November 14, 1868, 1:12 a. m., showing effect on vertical train of currents in opposite directions at different levels.

when streak-producing meteors are common, a few trains should be observed during each shower. Wherever there are two observatories separated by a distance suitable for a good base line, so that the trains can be triangulated and their altitudes determined, important results could be expected. Some form of small telescope for noting the drift among the stars would be the only instrument required. A train visible a few seconds to the naked eye would probably be visible a minute or more in a telescope, a fact demonstrated by Barnard, Denning, and others.

Meteor trains are by no means as rare as generally supposed. On one occasion nine separate trains were recorded by one observer in England using a small telescope during an evening of an ordinary Perseid shower in August.

It is hoped that when meteor trains are observed in the United States in future, the *exact position and change of position among the stars* may be noted at the time. In this way the altitude and drift can often be determined, for a conspicuous train is usually seen from one or more observatories and by reliable amateur meteor observers.

In 1901 several long-enduring trains were doubly observed in the United States, but the altitudes of these trains have not been worked out. It is much to be regretted that there is now no one taking the lead in collecting and calculating meteor data, to follow in the steps of the late Prof. Herbert A. Newton of Yale University, who accomplished so much in advancing the science of meteoric astronomy. It is an unusual opportunity for some one to take charge of such work in the United States. In Great Britain there are a score or more of careful observers, headed by Mr. W. F. Denning of Bristol, England, who is now the leading authority on the subject. The late Prof. A. S. Herschel, whose death has recently occurred, was also very active as a meteor observer, and the Luminous Meteor Committee of the British Astronomical Association, which reports annually its meteor observations, is also progressive.

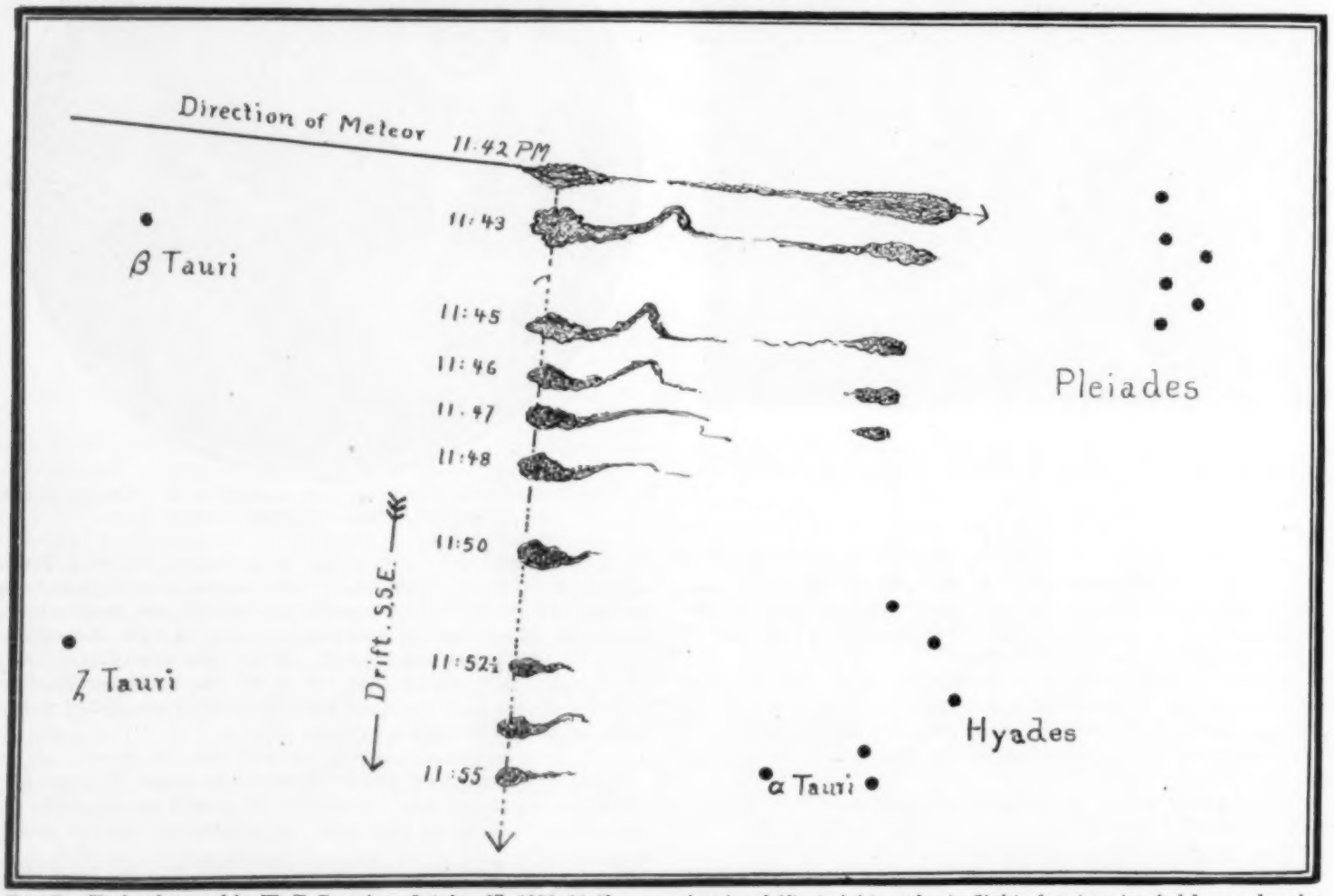

FIG. 7.—Train observed by W. F. Denning, October 27, 1900, 11:42 p. m., showing drift at right-angles to flight of meteor (copied from a drawing sent to the writer by the observer).

If the observations of meteor-train drifts were reported to one observer or to a specially appointed committee, whether the observations are made casually or from the result of a well organized plan, it would seem probable that in a few years enough drifts could be recorded to bring to light much concerning the movement of the higher atmosphere.

In closing I wish to thank the editorial staff for kindly furnishing me with some valuable data on meteor trains found in the files of the MONTHLY WEATHER REVIEW, and also Miss F. Harpham, of the astronomical computing staff at Columbia University, for assistance rendered on several occasions.

SPECTRAL FORMS IN MIST AND RAIN.

Talla Water is a lake from which Edinburgh derives its water. According to Dr. Hugh Robert Mill, director of the British rainfall organization (see British Rainfall, 1903, p. 49) "Talla is a classic land of rain". Sir Archibald Gilkie refers to it in his Scottish Reminiscences, thus:

> The Talla Valley is narrow and deep, the hills rising steeply from 1,000 to 1,400 feet above the flat alluvial trough at the bottom, which is about 900 feet above the sea. In the days of which I am speaking it was a lonely, sequestered glen, silent save for the bleat of the sheep or the bark of the dogs. In wet weather the wind drove up or down the defile, separating the rain into long vertical shafts, which chased each other like pale spectres. In the narrower tributary gorge of the Games-hope these ghost-like forms are even more marked; hence they are known in the district as the "white men of Games-hope".

STUDIES OF FROST AND ICE CRYSTALS.

BY WILSON A. BENTLEY. Dated Jericho, Vt., May 28, 1906. Revised July, 1907.

(Continued from August Review.)

The extreme difficulty of detaching and securing entire specimens of this type of frost for our purposes has prevented our photographing more than a very few of them. Those that the author succeeded with were, with but one exception, formed around frost nuclei upon windowpanes. For examples of this type of hoarfrost as formed in the open air, see No. 27 A. For additional mention of this type as found indoors on windowpanes, see No. 154 A, type WMD, in section 34, and Nos. 154 B and 161, type WSE, in section 35.

It is of much interest to find within this type of crystal, as within the other similar types heretofore mentioned, systems of air tubes and air inclusions. With the other points of similarity between them this serves to establish still more clearly the probability of the common origin of such air inclusions within both snow and frost crystals.

(17) HTG. Tabular snow crystals with hoarfrost additions.

A most important phase touching both snow and frost study is that relating to changes in habits of growth that may be induced by changes in environment. Very interesting opportunities are occasionally furnished for studying effects of this character, for on rare occasions snow crystals fall at nightfall, and hoarfrost crystal additions form in graft-like fashion upon them before they are modified by evaporation or by melting. This enables the student of crystallography to observe whether such hoarfrost additions as form on and grow outward from such fallen snow crystals conform to their own natural habits of growth, or to those of the fallen snow crystals. It would appear, from what the writer has learned from such few cases as have come under his own observation, that the hoarfrost additions, or grafts, grow and conform to hoarfrost types, rather than to snow-crystal types. Our photographs Nos. 96, 97, 98, and 99 show hoarfrost grafts or additions attached to freshly fallen snow crystals. It is remarkable that all the snow crystals of this series, as well as all the others having hoarfrost additions that have come under the writer's observation, are of a similar branch-like character.

It will be noted by consulting the photographs that in all but one the hoarfrost additions grew in a broad, solid, tabular fashion, in marked contrast to that of the frail, branch-like, snow crystals from which they started. Only in one case, that of No. 99 (which it will be noted portrays but a single segment, or branch-like ray added to the snow crystal), does the hoarfrost addition show a general near resemblance to the snow crystal from which it grew.

COLUMNAR HOARFROST.

Under this title are grouped all hoarfrost crystals that assume the forms of solid or hollow hexagonal columns, hollow hexagonal funnels, combinations of these to form compound crystals, and longitudinally bisected segments of columns and funnels.

(18) Type HCA. Columnar hoarfrost. Hollow columns.

Crystals of this type form in the shape of hollow hexagonal cylinder-like columns. This type of the column is commonly less slender and less elongated in the direction of its main axis than are those of the solid and of the solid fibrous types of the column to be described later. They vary in size from perhaps one-sixteenth to one-sixth of an inch in longer diameter. Many of them taper somewhat toward their bases. When formed in the open, they are essentially mild-weather types. They are most common to early autumn and late spring, and the hoarfrost that collects upon the plants and grasses during the so-called destructive frosts at those dates is almost invariably of this type. Hoarfrost deposits of this character form in the open during calm, clear nights when the surface air temperatures range from 56° to 40° at nightfall, and from 32° to 25° during the latter part of the night or early morning. Sometimes the cold becomes most intense and frost forms most rapidly in the early morning hours between daybreak and sunrise. Crystals of this HCA type rarely or never appear in relatively large numbers in the open simultaneously and associated with tabular hoarfrost crystals. During nights when tabular hoarfrost crystals predominate, this type, HCA, forms in general only on the bare ground and on the under sides of such objects as wood, leaves, straw, etc., that lie directly upon the bare earth, and not insulated from it.

In winter time the shorter and more perfect specimens of this type of frost are of relatively rare occurrence upon the shrubs, grasses, etc., in the open; but they frequently form in winter within relatively warm and inclosed, or partly inclosed, air chambers, as on the sides and roofs of cavities in the snow extending down to moist soil or water, on the under sides of water-trough covers, or of objects such as wood, embedded in the snow. In such confined situations they often grow for a long period of time, and hence attain much greater dimensions than in the open. Many of the individual crystals of this type exhibit but little variety, and a few specimens serve to carry an idea of all. It sometimes happens that they combine with hollow funnel-shaped crystals; funnel-shaped additions grow outward from the apices of the hollow columns and form compound crystals, presumably as a result of a change in atmospheric conditions. (See type HCE.)

Our photographs, Nos. 36 A, 36 B, 36 C, 36 D, and 36 E, quite correctly portray the aspect and general forms of such types of columnar hoarfrost crystals. Nos. 36 A and 36 E show them as collected in autumn and spring during destructive frosts upon grass blades and strawberry-plant leaves, respectively. Nos. 36 B and 36 C show these forms more highly magnified. No. 36 D pictures them as crystallized upon a cedar post.

(19) Type HCB. Columnar hoarfrost. Solid columns.

Hoarfrost crystals of this type grow in the form of the solid column. There are three varieties of the solid column. Some grow in the form of long, slender icy needles, others in a quasi fibroid form. One variety grows in the form of relatively short hexagonal columns, which greatly resemble crystals of type HCA, and in fact differ from them only in this,

that each of the six respective walls or sides of the column possesses so great a thickness that they almost or quite meet at the center of the main axis, and hence leave no space, or but a very small cavity, between the several surrounding walls of the hexagonal column (see photograph No. 36 A). The fibroid and the needle-shaped crystals are peculiarly extreme cold, zero-weather types. They most frequently form and lie in a horizontal manner directly upon the bare surface of pond and river ice, or directly upon bare compacted soil. They rarely or never grow upward from soil or ice, as do the branching tabular frost crystals (types HTD and HTE) so often found associated upon the ice with them. Walls abounding in cracks and small apertures thru which strong cold and moist air currents circulate are often coated with a subcrystalline granulo-fibroid variety of solid columnar hoarfrost. Crystals of a similar character, and also long needle-shaped ones, sometimes form upon the snow and other objects that inclose or closely adjoin open flowing springs of water. As previously noted, the clouds enshrouding mountain summits often deposit a portion of their moisture in the form of cloud frost crystals of a form and character similar to those just described. Mountain climbers assert that crystals of this character sometimes grow to an astonishing size in such high situations under the influence of a steady stream of cloudy air. Needle-like and fibroid crystals, as commonly formed on ice and soil, vary in length from a fraction of an inch to as much as one or two inches. It is of interest to note that each of the several varieties of solid columnar hoarfrost crystals is represented by corresponding prototypes among the snow crystals. Our photograph, No. 27 C, shows the form and aspect of solid columnar needle-shaped hoarfrost crystals as formed on bare ice, and No. 27 D pictures them as they appear collected upon the bare soil. The columnar crystals are identically alike whether formed on bare ice or on bare soil. No. 35 A shows typical specimens such as crystallize on plants and grasses, boards, and other objects.

(20) Type HCC. Columnar hoarfrost. Hollow funnels.

These singular crystals of frost form in the shape of hollow hexagonal funnels. They occur both as distinct entities by themselves, and as attached to the apices of hollow columnar frost crystals of type HCA. They occur both during extreme cold and during relatively mild temperatures, but most frequently during moderate degrees of cold, and form in various situations, both in the open and within inclosed situations. They rarely grow to a very large size. The degree or angle at which the sides of the funnels flare outward from an imaginary central perpendicular axis varies in different crystals. In some rare cases, as in No. 116 for example, the walls of the funnel flare outward at an extreme, and almost perpendicular, angle, but more frequently the sides of the funnels flare outward at angles more nearly approximating 60°, as shown in photographs Nos. 37 and 225. Sometimes six segmentary points or rays are found attached to and growing upward from each of the six points or angles where the several sides of the funnel meet, in the manner shown in photographs Nos. 116 and 225. (No. 225, it should be noted, is a photograph of an artificial illustrative model.) These projecting points probably give us the clue to the manner in which this type of crystal grows. Many of them doubtless grow, after being fully organized, by first throwing outward and upward points or rays as in No. 116, and then follows a process of growth that accomplishes the filling in of the open side spaces lying between the several points. This alternate process of growth is repeated from time to time until completion. It is most strange, in view of the fact that columnar frost crystals form in great numbers, and under most varied conditions, environments, etc., that tabular outgrowths do not form and grow outward from the sides or ends of such columns on a perpendicular to their main axes, in the same manner as do the tabular additions that so frequently form upon columnar snow crystals, resulting in doublets, or the cuff-button type.

The additions that grow outward from the apices or ends of columnar frost crystals, and that go to form the funnel additions thereto, evidently correspond most closely to the snow crystal doublet additions just described, yet for some inexplicable reason practically all the growth of this character added to the columnar frost crystals is grafted on, and grows outward from such columns, at angles of about 60°, and forms funnel-like additions, instead of growing at angles of 90° to form tabular plate-like additions, such as the snow doublets possess.

(21) Type HCD. Columnar hoarfrost. Longitudinal segments.

These queer types of frost crystals form in the shape of longitudinally bisected segments of hollow hexagonal and hollow funnel-like crystals. They seem to form largely or invariably within confined situations, as within hollow trees or cavities therein, between layers of ice, on the ceilings of barn cellars, and beneath blocks of wood, metal, etc., embedded in the snow. They usually assume a horizontal or oblique position upon the object upon which they form, and rarely or never grow outward perpendicularly to the face of such object. In some cases the apices of such crystals possess cap-like icy projections that extend outward normal to their facets.

(22) Type HCE. Hoarfrost. Compound crystals.

Compound hoarfrost crystals consist of two or more distinct types combined and united one to another. Crystals of this character are produced as a result of some change taking place in the rates and habits of growth which operates to produce crystals of a different type from that of the basal crystal upon which they graft themselves. Compound crystals form much more frequently in confined situations and within inclosed air spaces than in the open, yet one variety, a combination of column and funnel, sometimes forms occasionally in the open. They seem to be common to various temperatures.

Our photographs Nos. 162, 163, 201, 206, 207 A picture some very interesting specimens of compound crystals. In the case of Nos. 162 and 163 hollow hexagonal columns formed upon and around and grew from the angles of basal tabular crystals in a direction parallel to their faces. This is a somewhat rare combination.

Perhaps the most common type of compound crystal is formed in the very interesting manner shown in photograph No. 201, i. e., thru funnel growth forming and growing upward from the apices of hollow columnar crystals.

In the case of the variety of compound crystals shown in photograph No. 206, a perfectly solid and transparent short, square-ended, quasi-trigonal columnar crystal formed and grew upon and above a thick tabular crystal. Crystals of this gem-like character are sometimes, as in this case, perfectly limpid and free from internal markings due to air inclusions, and possess brilliant, clean-cut facets that flash and sparkle in true gem fashion.

In the case of No. 207 A, we see another variation in the form of the solid prismatic crystal as described above. In this case the crystal is viewed from the side. Its ends, instead of terminating in plain facets, as in No. 206, terminate in oblique facets. Unlike No. 206, it possesses interior lines and shadings, presumably due to included air. So far as observed, short, gem-like, frost crystals, resembling those just described, form only in inclosed situations wherein moisture gathers, as upon the under sides of blocks of wood embedded in the snow, in hollow trees, or cavities therein, and within other cavities similar to those wherein type HCD forms.

Occasionally crystals of frost that form upon the under sides of objects embedded in the snow assume very strange and rare forms indeed. Photograph No. 207 C portrays specimens of

great rarity and interest. These are viewed endwise in the photograph. They grow upon cubical rather than hexagonal plans, assuming the form of the inverted cubical pyramid. They grow upward in such a manner that what should be the apex of the pyramid is below and supports them, while the base proper is above, and forms the summit. A most remarkable feature about them is the presence of shallow, four-sided cavities or depressions extending downward from their upper, basal portions. The outlines of these cavities may be plainly seen in the photograph.

This rare and strange form of hoarfrost crystal has no prototype among the snow and ice crystals, and only some of those that result from the evaporation and recrystallization of old snow beneath a hard snow crust, during intense and long-continued cold, at all resemble it. Crystals of snow-frost of this latter character will next be considered.

(23) Type HCF. Snow-frost crystals.

In addition to the various types of frost crystals previously described there are others that form within and beneath the surface of old snow. Frost crystals of this character draw their supplies of moisture largely from that which results from the partial evaporation or sublimation of snow crystals and of snow granules. Snow-frost crystals presumably form both on nuclei of their own making, and on the individual snow granules of which old snow is in part composed. They assume solid columnar and some other related forms. Some of them resemble cubes, and cubical pyramids. Many of them greatly resemble the short prismatic crystals of frost last described, type HCE. In many cases they are almost as broad as they are long. Such masses of metamorphosed snow are much heavier than new snow, and have a salt-like aspect and behavior, and melt very slowly. Photograph No. 207 B will serve to convey some idea of the general forms of such snow-frost crystals. As will be noted they closely resemble the one in photograph No. 207 A.

A very interesting account of this variety of snow frost will be found in an article by Mr. J. Wolley, M. A., in the Report of the British Association for 1858, part 2, pp. 40–41, reprinted in the MONTHLY WEATHER REVIEW for April, 1905, p. 158.

III.—WINDOW-FROST CRYSTALS IN GENERAL.

(24) Introduction.

Window-frost crystallizations are so instructive that they require especial mention in a chapter by themselves.

In view of the great beauty and variety of these fairy-like formations, and the ease with which they can be studied and photographed, it is surprising that so few of them have been photographed and published. We recall but one illustrated article treating of them, which was written by Mr. Babcock, of Wisconsin, and appeared in a recent number of the St. Nicholas Magazine.

(25) General conditions for formation.

Before proceeding to group and classify window-frost crystals, we will briefly state the general conditions under which they form, and what conditions or factors seem to determine their form and structure, together with some other facts and speculations of general interest. It may be well to state here also that the large feather-like and other crystals that so frequently form within a thin film of water, covering windowpanes within artificially heated rooms, are not frost crystals, but varieties of ice crystals, and as such receive mention later under the title "Window-ice crystals".

Window-frost crystals form under varying conditions of temperature, humidity, exposure, and environment. They freely form upon the windowpanes in both cold and warm rooms. True crystalline window frost forms only in a quiet, or relatively quiet, atmosphere, and commonly only when the outdoor temperature is several degrees below the freezing point of water, and four or more degrees lower than the temperature indoors.

In general true window-frost crystals form only when the humidity indoors is not excessive. When interior moisture exceeds a certain point (about 95 per cent relative humidity), a dew-like deposit of moisture, consisting of minute liquid water particles, forms upon the window glass and freezes in granular form thereon, so as to prevent the formation of true frost crystals. (See granular window frost, type WGK, sections 42, 43, 44.)

(26) Special manner of formation.

Window-frost crystals may be divided into two principal divisions: (1), those that form in minute striations or scratches in the glass, recurring time and again in the same position on the glass; (2), those that form outside and seemingly independent of such striations, and do not form repeatedly in the same position on the glass.

Doubtless in general, the nuclei of those varieties or types of window frost that form and grow without the striations in the glass, collect within minute indentations therein, or upon particles of foreign substances thereon, or form and attach themselves to the slightly thinner and consequently colder points upon its surface. Were it possible for conditions and the state of the surface of the glass to be such as would allow window-frost crystals to grow freely in all directions and in a perfectly natural manner, as do many of the snow crystals, they would doubtless grow and develop into exquisitely beautiful and symmetrical crystal structures. They would, indeed, exceed snow crystals in beauty and complexity of outline, tho of course not in beauty and complexity of interior. Even under the imperfect conditions, such as prevail upon ordinary windowpanes, many of them, as all know, develop into forms of great loveliness, and some of them even succeed in growing upon the glass in a very natural way, i. e., in the form of branching six-rayed hexagonal stars. Yet it is rarely the case, even when they succeed in growing in the manner last described, that they can grow in a perfect symmetrical manner, for even when crowding does not interfere with or prevent them from growing symmetrically, other factors generally do so. The inequalities in thickness, and the resultant variations in coldness of different portions of the glass, and the presence at some points and absence at others of aggregations of dust particles thereon, and the direction and force, as well as varying temperatures, etc., of the tiny air currents that flow over its surface, usually operate to favor and unduly stimulate the growth of certain portions of a given crystal, and to retard the growth of others. What part the dust particles play in forming centers for crystallic nucleation to commence upon is as yet problematical.

(27) Relation of crystals to foreign substances.

When the crystallization of a given salt or substance in solution is taking place, that salt or substance tends to exclude all foreign salts and substances from entering into the crystallic structures which it creates, and to produce chemically pure crystals. It is not clear to the writer how this well-known fact can be made to harmonize with the present belief that snow, frost, and ice crystals, as well as dew and raindrops, adopt and form only around dust particles, i. e., upon substances of an alien nature. The writer's own observations of window-frost crystallization lead him to the belief that window-frost crystals form with even greater freedom on newly cleaned window glass than they do on uncleaned, dust-covered panes, and he has no doubt but that they would form freely upon windowpanes rendered by chemical processes free from dust particles. The writer has frequently noted that the presence of excessive quantities of dust upon windowpanes tends to prevent the formation of the more beautiful of the frost crystallizations thereon.

Of course, in the case of the frost crystals, they must in many cases necessarily form, or at least rest upon, substances of a foreign nature, such as window glass, grass, plant leaves, etc. We may confidently assume, however, that in a majority of cases microscopic dew droplets collect and freeze upon the substances upon which hoarfrost crystallizes, prior to the formation of such frost crystals, and that these furnish tiny ice nuclei for the latter to form upon.

(28) Effect of temperature and humidity.

The temperature and humidity of the air, and especially the outdoor air temperature, exert a great influence upon, if, indeed, in many cases they do not actually determine, form, type, and structure of the window-frost crystals. Yet it would seem that other factors sometimes enter into the problem, because it often happens that two or more distinct types form and grow simultaneously upon a given windowpane. Doubtless, as Prof. J. P. Iddings suggests, form and structure depend largely upon their rates of growth, and the rapidity of the change of the temperature and humidity of the air. Certain types seem to be common to various diverse temperatures and humidities, for they freely form within both warm and cold rooms.

Some seem to form only within certain limited ranges of temperature and humidity, but others only at very low temperatures. In general the smaller and more solid types form most freely in a very cold atmosphere, and increase in number with a decrease in temperature. Singularly enough, certain branchy, open-structure types also form freely during intense cold, provided the humidity is considerable and moisture is freely supplied. By far the greater number of the more beautiful and interesting window-frost crystals form within cold, unheated rooms, and in temperatures ranging from 36° to 5° F. The great majority of those observed and photographed by the writer formed within such cold, unheated rooms. If care is taken to provide or select rooms varying greatly one from another as regards their temperatures and humidities, frost crystals can be observed and studied therein under almost as favorable and varied a range of conditions as within the laboratory itself. The writer has for many years conducted a series of observations under varied conditions such as just described. Three rooms were selected within which to observe window-frost crystallization. One of these possest a very cold, humid atmosphere, an open water tank with running water being therein, the second possest a very dry atmosphere, and the remaining one an atmosphere neither very dry nor very humid. Early in the winter of 1906–7, the Weather Bureau kindly loaned me a sling psychrometer to aid in my observations and to record the precise temperatures and humidities within these several rooms while particular types of frost were in process of formation. The results of my observations may possibly be of interest. Window frost formed upon the windowpanes within the driest of the three rooms upon 52 separate occasions, and upon the windowpanes within the other two rooms upon over 60 different dates; thus furnishing over 170 distinct opportunities for observing and studying window frost, and the temperatures and humidities prevailing while it was in process of formation.

It should be noted here that these observations, being conducted only within cold, unheated rooms, give complete data only as regards types of frost common to such cold rooms. This should be borne in mind when consulting Tables 1, 2, 3, giving the relative frequency of occurrence of the various types. These three tables show that in general the majority of the frost types were formed within atmospheres ranging in relative humidity from 55 to 70 per cent and in temperature from 36° to 5° F. (indoors). Within the coldest and most humid room, however, the majority of types formed when the relative humidities were higher and ranged from 74 to 86 per cent. Frost formed in a few cases in an atmosphere having relative humidity of but 47 per cent, while in others (within the coldest room) it formed when the relative humidity was as high as 92 per cent. It is surprising, indeed, as was found to be the case, that so many of the types of frost should form under such varying conditions and ranges of humidity and temperature. Among the facts of interest that we noted regarding the occurrence of the various frost types was this, that the types we have designated as WOH and

TABLE 1.—*Total number of occurrences of various types of window-frost crystals within the several cold, unheated rooms, in connection with various outdoor temperatures.*

Outdoor temperature.	WGK.	WLA.	WBB.	WFC.	WMD.	WSE.	WLF.	WCG.	WOH.	WTI.	WFJ.
° F.											
30	2	2	2	.....	.....	.....	.....	.....	.....	.....	.....
25	1	1	1	.....	.....	.....	.....	.....	2	.....	.....
20	2	2	2	.....	.....	.....	.....	.....	2	.....	.....
15	13	15	11	.....	.....	.....	.....	.....	2	1	2
10	17	14	17	2	2	2	.....	.....	4	0	2
5	16	14	17	10	0	2	.....	.....	4	3	3
0	22	18	27	13	3	5	2	.....	3	8	10
— 5	13	14	10	9	2	4	3	.....	1	3	3
—10	13	14	23	7	3	10	5	1	3	8	4
—15	6	6	13	10	7	14	5	2	0	7	1
—20	6	8	15	4	6	7	10	3	1	12	2
—25	5	0	9	3	5	0	9	6	0	8	0
Total ..	117	108	147	64	28	54	34	12	22	50	27

TABLE 2.—*Total number of occurrences of various types of window-frost crystals in cold, unheated rooms, in connection with various indoor temperatures.**

Indoor temperature.	WGK.	WLA.	WBB.	WFC.	WMD.	WSE.	WLF.	WCG.	WOH.	WTI.	WFJ.
° F.											
36	6	6	4	.....	.....	.....	.....	.....	2	.....	.....
33	8	8	8	.....	.....	.....	.....	.....	3	.....	2
30	13	14	16	5	.....	.....	.....	.....	4	.....	3
27	16	16	18	3	.....	.....	.....	.....	6	3	2
24	15	16	18	8	1	3	.....	.....	3	2	6
21	14	13	18	9	1	4	1	.....	1	4	2
18	15	14	16	10	3	7	2	1	1	7	1
15	9	7	12	11	4	5	2	1	1	11	0
12	7	6	13	4	4	12	9	2	.....	10	1
9	8	4	11	5	5	8	8	3	1	8	1
6	5	3	10	6	7	8	7	3	1	5	0
3	1	1	5	2	3	5	5	2	0	.....	.....
Total ..	117	108	147	64	28	54	34	12	22	50	27

TABLE 3.—*Total number of occurrences of the various types of window-frost crystals within the several cold, unheated rooms in connection with various indoor humidities.**

Relative humidity indoors.	WGK.	WLA.	WBB.	WFC.	WMD.	WSE.	WLF.	WCG.	WOH.	WTI.	WFJ.
%											
41	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
44	.....	.....	1	.....	1	1	1	.....	.....	1	.....
47	.....	.....	1	1	.....	.....	.....	.....	.....	.....	.....
50	2	2	2	1	.....	1	1	.....	.....	1	.....
53	4	4	5	5	.....	4	1	.....	.....	3	1
56	14	19	20	8	.....	7	2	.....	3	5	1
59	16	21	22	9	3	8	3	1	2	6	3
62	17	10	21	10	3	5	3	1	4	4	4
65	14	15	20	7	4	4	3	2	7	4	5
68	4	5	8	4	2	2	1	1	2	3	3
71	4	4	3	.....	.....	1	1	.....	.....	2	.....
74	9	8	9	3	1	2	2	1	2	1	1
77	7	9	8	4	2	4	3	.....	.....	3	2
80	6	7	10	4	3	3	3	.....	2	4	3
83	4	2	6	5	4	4	4	2	.....	5	2
86	4	2	7	1	4	5	3	4	.....	6	1
89	1	1	2	1	1	2	2	.....	.....	1	1
92	0	1	1	1	1	1	1	.....	.....	1	.....
Total...	106	108	147	64	28	54	34	12	22	50	27

*It is to be noted that practically all the frost forms that occurred within atmospheres possessing relative humidity of over 71 per cent formed only within the coldest room in which the running water and open water tank were situated. It should be further noted that practically all the frost forms that occurred wherever the indoor temperature was above 24° F. formed within the two warmer rooms.

WFJ failed to form upon the windowpanes within the least humid room. We may conclude from this that they form only under relatively high degrees of humidity. Frost formed in some instances within the two warmer rooms when the temperature indoors stood at 36° F. and outdoors at 30° and 28° F.; but in only one instance did frost form upon the windowpanes within the coldest room until the indoor temperature had fallen to at least 24° F. The several types of frost possessing close, solid forms, which we have termed types WTI, WLF, WSE, form only when the indoor temperature stands at 24° F. or below and the outdoor at 15° or below. Their occurrence at a given temperature, however, depends somewhat upon humidity, for they formed upon the windowpanes within the driest and least humid of the several rooms only when the indoor temperature stood at 20° F. or below and the outdoor at 15° F. or below. The student who wishes to pursue further the matter relating to the occurrence of the various types under diverse conditions may find much of interest in the appended Tables 1, 2, 3.

(29) Repulsion between crystals and liquid particles.

One of the most singular, and doubtless most important, phenomena that occur in connection with the formation of window frost is this: The true crystalline varieties of window frost ordinarily, apparently, repel the minute liquid particles or droplets of water that frequently collect like tiny dewdrops on the glass, and freeze in granular form thereon. (See window frost, type WGK, section 41.) This phenomenon is endowed with the greatest interest, because the repulsion operates also within the clouds while snow crystals are in process of formation, and hence has an important bearing on forms and structure of snow crystals, and in keeping them free from granular deposits of a like nature. If, as is presumably the case, snow crystals, under ordinary conditions of humidity, also naturally repel the liquid cloud or mist particles that surround them while within the clouds, this offers a true and complete explanation of why these particles so frequently escape colliding with crystals, and are prevented from attaching themselves in granular form to true snow crystals while the latter are falling thru the clouds. It is quite possible that were it not for this repellent phenomenon, enacted within the clouds among the snow crystals, clear, transparent, and beautiful snow crystals would rarely, or never, occur in nature, and fall to earth.

We can only conjecture as to the cause of this most interesting phenomenon. It may be of an electrical nature. Possibly both the snow and frost, and the liquid cloud or dew droplets, possess an excess of the same kind of electricity, positive or negative. If so they would naturally repel each other. Much discussion has arisen from the fact that window-frost and window-ice crystals within rooms heated artificially form first and in greater quantity upon the lower portions of the windowpanes. That they do so is owing largely, if not wholly, to the fact that cold, outside air enters at the top of each window and where the two sashes meet, and being so much heavier than the warm, indoor air, flows downward, and laves the greater part of the upper portion of such windowpanes. The same thing will happen, tho to a lesser extent, as regards the sides of the panes, if an aperture be made for the outside air to enter in such a way as to lead it out over the surface of the glass. That outside air enters at the top of such sashes during the winter time, and flows downward, may be proved by holding a smoking stick close to the top of each window sash and observing how the smoke is driven downward by such inflowing and descending cold, outdoor air. The explanation of the phenomenon of the deposition of window frost and dew in greater quantity upon the lower than upon the upper portions of the windowpanes lies largely in this fact, that the cold, heavy, outdoor air that enters at the top of each window sash and flows downward over its upper portions, is usually relatively much drier than is the indoor air, and hence not in condition, when it first enters, to deposit any of its moisture upon the glass in the form of frost or dew. But as it flows downward toward the bottoms of the panes, it mixes more and more with the warm, moist air that it meets on its downward journey, and tends to chill it, and hence to bring the latter into a condition of supersaturation for its temperature whereby it must deposit some of its moisture upon the windowpanes, in the form of frost or dew. This phenomenon occurs but feebly, or not at all, as regards the frost and dew that collects upon the windowpanes within cold, unheated rooms.

IV.—CLASSIFICATION OF WINDOW-FROST CRYSTALS.

(30) List of types.

The numerous varieties or types of window frost that recur so often and in such characteristic forms seem to be entitled to receive separate mention as distinct types. Each has been given a distinguishing name, as below, because of certain peculiarities of form or of resemblance to the forms of certain objects in nature. Their place in the following list accords as nearly as practicable with the relative frequency of their respective occurrence both within cold, unheated, and warm, heated rooms.

Type WLA. Linear crystals; resembling serrated lines.
Type WBB. "Branch like"; resembling trees, ferns, etc.
Type WFC. "Filamentous"; resembling sea moss, etc.
Type WMD. "Meandering", tufted forms.
Type WSE. "Stelliform"; resembling stars.
Type WLF. Solid "lamellar" crystals.
Type WCG. "Columnar"; resembling columns.
Type WOH. "Open", wrench-like forms.
Type WTI. "Tooth-shaped" crystals.
Type WFJ. "Fibroid" forms; resembling fibers.
Type WGK. "Granular" frozen dew frost.

Each of these several types will, in accordance with our scheme of treatment, receive separate mention in the following sections.

(31) Type WLA. Linear crystals.

This very common type of window frost occurs upon window glass in the form of long, slender, serrated thread-like crystals. Large numbers of such crystals often cross and recross one another upon the glass and thus form delicate lace-like designs thereon. Linear crystals grow both in straight and in curving fashion, but most commonly pursue nearly straight paths. They commonly if not invariably form within minute natural striations within the glass, but will also often form within those made artificially, and hence may be made to follow and to elaborate artificial designs that may be scratched on the glass. They consist of a nuclear or quill portion lying wholly within the striation or scratch in the glass, and of an outlying serrated portion, consisting of myriads of tiny and usually very short secondary rays or branches shooting outward at various nearly perpendicular angles from the nuclear quill. They freely form both within cold and within heated rooms, and under varying degrees of cold and humidity, and form freely in a very humid atmosphere. They often grow very rapidly under humid conditions, threading large glass areas in a very short time. They are most common to heated rooms, and are often found forming and growing upon the same pane of glass in association with granular window frost, type WGK. When cold, moist rooms are slowly warmed in winter these two types often form and replace each other in alternate order upon the glass. Usually tiny serrated frost crystals appear first upon the lower portions of the windowpanes; but as the warmth and humidity within the room increase dew-like deposits form around the linear crystals and extend somewhat above the portions of the lower part of the pane whereon the linear crystals formed. This dew-like deposit immediately freezes upon the glass in granular form and covers

all the dry glass spaces lying around, but not close to, the linear crystals. The deposition of this dew-like deposit momentarily reduces the humidity of the air near the windowpane, and as a result linear frost crystals again form on the dry, unoccupied glass spaces lying just above the limits of the dew-like granular film. This alternate process of the formation of frost and then of dew deposits upon the windowpanes is repeated time and again until the windowpanes may be entirely covered by such mixt deposits. Whenever the humidity momentarily exceeds a certain point dew-like deposits collect upon the glass, and whenever it is momentarily reduced below a certain point frost deposits collect. The subsequent melting of this thin film of frost and frozen dew forms the thin films of water that so often cover windowpanes in winter and within which the beautiful feathery window-ice crystals form. (See window-ice crystals, section 45.)

Typical examples of linear frost crystals are shown in our photographs Nos. 29, 100, 107, and 126. It is to be noted that the remaining numbers of our series showing this type of crystals, Nos. 25, 44, 45, 108, 185, 186, 187, 192, and 193, contain other types of crystals, or sections of granular film, type WGK, in addition to the linear crystals under consideration. Linear window-frost crystals often develop in the form of various fanciful figures. No. 100, for instance, has a close and remarkable resemblance to telegraph poles and lines, while No. 108 outlines a beautiful and delicate cross.

Nos. 185, 186, 187, and 193 formed slowly within a cold room. They exhibit the handiwork of the frost in imitating the letters of the alphabet, and in following and elaborating artificial designs scratched with carborundum upon a windowpane. The writer scratched his initials upon a windowpane, and a curved line above, and each winter, from time to time, linear frost crystals form within those scratches and evolve beautiful and artistic letters resembling those shown in Nos. 185, 186, 187, 192 and 193. Nos. 185 and 193 show this formation in its first or skeleton stage. Nos. 186 and 187 were taken at a second stage and portray the decorative efforts of the frost, in still further elaborating and adding to the original skeleton design.

(32) Type WBB. Branching window frost.

Window-frost crystals of this type possess open, branching tree, fern, or star-like forms. They vary greatly one from another in size, the number and arrangement of both primary and secondary rays, etc. Hardly two form and grow to be just alike in every particular.

They possess from one to six or eight primary or quill rays, and in many cases myriads of secondary ones. The secondary rays, in general, project at angles of about 60° from the primary quill rays, yet in many cases they deviate from this rule and grow outward at perpendicular and various other angles. In general, both primary and secondary rays grow in straight or but slightly curving fashion, and both are usually of a somewhat thick and substantial character. They are essentially fast-growing types of window frost. This type of crystal is common to both warm and cold rooms and to various temperatures, etc., but is most common to cold, unheated rooms and indoor temperatures ranging from 32° to 5° F., and humidity 55 to 70 per cent. It furnishes many of the most beautiful window-frost designs, and countless windowpanes in winter are beautified by it. This, as well as all other types of window frost and window ice, gleams and glistens in a most beautiful manner upon the windowpanes; but of course this is all lost in the photograph. Only those who have seen frosted windowpanes lit up by a bright winter moon, or seen them flash and sparkle under the rays of a winter sun, have seen the full beauty of the frost.

There is little room for doubt that were it not for minute inequalities in the thickness and the surface of the window glass on which they form, this type of window-frost crystal would often develop in a perfectly symmetrical hexagonal manner, in six-pointed star-like forms that would rival in beauty certain branching forms of snow crystals, which closely resemble them. (See Nos. 21, 95, 119 A, 119 B, and 128.) We have secured a large number of photographs of this elegant type of window-frost crystals, among which will be found many of the choicest and most beautiful designs.

The series of photographs of such is as follows:

Nos. 3, 4, 5, 10, 21, 22, 23, 40, 42, 43, 48, 54, 55, 56, 60, 64, 65, 66 B, 67, 69, 70, 77, 85, 95, 102, 103, 104, 105, 106, 109, 112, 119 A, 119 B, 122, 123, 124, 125, 128, 143, 144, 145 A, 145 B, 166, 167, 194, 202, 203, 204, 205, 219, 220, 222, 226, 227 A, 227 B, 227 C. Many of these, particularly Nos. 55, 64, 95, 102, 124, 194, 220, are exquisitely beautiful. No. 70 contains two crystals resembling spiders or crabs, which are so similar to each other as to deserve the title, "twins". Many of the individual crystals of this type grow and develop in the semblance of various fanciful designs, or so as to resemble certain natural objects.

No. 85 might well pass for a tapestry design; No. 102 for a sprig of fern; Nos. 119 B, 21, and 95 for snow crystals; Nos. 123, 124, and 167 for maple leaves; Nos. 145 A and 145 B for tiny trees wrought in crystal. The letter Y design in No. 144, and the scorpion design in No. 125 are also curious examples of the seemingly imitative work of the frost. Nos. 109 and 143 show typical frost formation occurring around ice and small icy particles frozen on a windowpane.

Sometimes the individual crystals of this type assume curving, spiral forms, and Nos. 54 and 102 are very interesting examples of such. The beautiful photograph, No. 220, shows a most elaborate design, evidently wrought out around a simple spider or crab-shaped nucleus, originally similar to No. 70. In No. 226 we see a fine example of triangular development. This type of window frost has many points of resemblance to the feather forms of window-ice crystals, and doubtless corresponds, type for type, with them. They thus have their prototypes both among the snow and the ice crystals. We shall include under this head a somewhat composite type of window frost.

These exquisite forms of frost possess somewhat meandering habits of growth, and in this regard resemble the type next to be described, type WFC, but unlike that they grow in a broad substantial manner, more like type WBB. In many cases their rays are even broader and more substantial than are the rays of type WBB. Crystals of this character form and grow outward from a common nucleus, in rosette-like forms, as shown in No. 227 B, or from granular frost, or other types of frost, in leaf or coral-like shapes as shown in No. 227 C.

(33) Type WFC. Filamentous type.

These extremely delicate and graceful frost crystals consist of a vast number of separate curving filaments of frost radiating outward, or in some general direction from a common center, or from such other window-frost crystals as they may form around, which serve as their nuclei. The slender delicate filaments of which they are composed almost invariably pursue sinuous, meandering, rather than straight or gently curving paths on the glass. They form almost exclusively upon windowpanes within cold rooms, and are most common to indoor temperatures ranging from 28° to 6° F., and humidities of 55° to 65 per cent and are often found associated thereon with various other types of window frost, but particularly with type WBB.

The mystery of why the ice filaments, of which it is composed, grow in such a sinuous and seemingly uncrystalline manner is as great as it is in the case of the corresponding meandering arborescent type of window-ice crystal, type IAB. Certain temperatures and humidities evidently favor its formation, because sometimes and in certain cases window-frost

crystals, especially of type WBB, cease to grow and are succeeded by type WFC. In many cases the latter type adopts the former as a nucleus and grows outward therefrom.

We have selected 18 examples of this most elegant type of window-frost crystal for use as illustrations, as follows: Nos. 30, 31, 42, 69, 73, 115, 117, 130, 131, 132, 146, 147, 148, 177, 179, 195, 196 A, 196 B. Nos. 130, 131, and 196 A are particularly lovely and interesting examples. As will be noted, some of them resemble sea moss. Tiny crystals of type WBB form the nuclei of specimens Nos. 130, 131, 132, and 195.

Sometimes a very slight change (increase) in the indoor humidity, accompanied by a fall of but a few degrees in outdoor temperature, will cause crystals of this type to form and grow between or around crystals of type WBB, as shown in the very interesting photograph No. 196 B.

(34) Type WMD. Meandering window frost.

These singular frost crystals consist in some cases of but a single straight or curving spike or quill, and in others of a central quill adorned with a few or with many secondary tuft-like branches. Such tuft-like secondary branches as may form upon and around the primary quill or spike usually appear clustered together into tufts thereon. Singularly enough many of the secondary branches grow outward from the central quill perpendicularly rather than at an angle of 60°.

These odd crystals are essentially very cold weather types and form only within cold, unheated rooms during below-zero weather. They form freely only when the indoor temperatures range from 15° F. downward. They form freely in a very cold atmosphere, when the relative humidity of the air ranges from 77 to 86 per cent, and less freely within warmer air at humidities of from 55 to 65 per cent. Sometimes the longer varieties of this type of crystal seem to possess a structure nearly continuous, as in Nos. 175, 176, and 178, while in other cases they seem to be built outwardly in sections, as in Nos. 58 A, 58 B, 59, 154 A, 154 B, and 188.

(35) Type WSE. Stelliform crystals.

Crystals of this type are of a somewhat close structure. In many cases a simple hexagonal star forms the nucleus, the rays of which terminate in tiny solid hexagonal plates.

They commonly form around and upon tiny bits of ice, or tiny frost crystals, and usually develop parallel to, but slightly raised from, the window glass, except when their nucleus is itself attached to the glass. They evidently grow outward in intermittent, rather than continuous, order, whenever the temperature suddenly falls, or a windowpane is suddenly cooled far below its previous temperature, as the result of a cold gust of wind suddenly springing up and striking it. They are slow-growing, cold weather types, and occur only in cold rooms and during below-zero weather. Indoor temperatures must be as low as 20° F. for them to form freely. They form most freely within cold rooms at humidities ranging from 74 to 90 per cent, less freely at milder temperatures, when the relative humidity ranges from 55 to 65 per cent.

They usually fail to attain perfectly symmetrical proportions, for the reason that they commonly form in such a position that their growth does not progress equally in all directions. In rare instances their position and environment is such as to allow development to proceed in all directions, and in such cases they assume quite symmetrical forms. See Nos. 161 and 154 B (it is to be noted that one point of No. 161 is broken partly off).

Crystals of this same general character sometimes form around, or develop annex-fashion from, other frost types. No. 145 A is a very beautiful and unique example, in which the stelliform crystal formed around and grew outward as an annex to the branching type of window frost, type WBB.

It is to be noted that this type of frost, altho for convenience grouped under the title "Window frost", develops largely outward from, and independent of, the surface of the glass, and hence is in reality a type of indoor hoarfrost. (See type HTF, tabular hoarfrost, section 16.)

[*To be continued.*]

INTERNATIONAL METEOROLOGY.

The following is an extract from an address by Prof. Arthur Schuster, of Manchester, delivered before the Royal Institution of Great Britain Friday, May 18, 1906, and is reprinted from Nature and from the Annual Report of the Smithsonian Institution for 1906:

In an address delivered to the British Association at its Belfast meeting, in 1902, I expressed the opinion that meteorology might be advanced more rapidly if all routine observations were stopped for a period of five years, the energy of observers being concentrated on the discussion of the results already obtained. I am glad to say that meteorologists have taken seriously a remark the echoes of which still reach me from distant parts of the earth. They disagree with me, but their disagreement is of the apologetic kind. I do not wish to retract or to weaken my previous statement, but merely now qualify it to the extent that it is only to be applied to two-dimensional meteorology. There is a three-dimensional meteorology as far removed from the one that confines itself to the surface of the earth as three-dimensional space is from a flat area. Three-dimensional meteorology is a new science, which at present requires the establishment of new facts before their discussion can properly begin. The extension of our range of observations by kites and balloons is of comparatively recent origin. Mr. Archibald in this country was one of the pioneers of meteorological investigation by means of instruments attached to kites. In the United States Mr. Rotch, having established a separate observatory, succeeded in convincing scientific men of the great value of the results which could be obtained. Mr. L. Teisserenc de Bort, who established and maintained an observatory for dynamic meteorology at Trappes, near Paris, rendered similar services with regard to "pilot" or unmanned balloons carrying autographical instruments. The aeronautical department of the Royal Prussian Meteorological Institute, with Doctor Assmann at its head, under the direction of Professor von Bezold, also made a number of important contributions in the early stages of the work. Professor Hergesell, of Strasburg, similarly made numerous experiments; and chiefly through the efforts of those whose names have been mentioned, and more especially Professor Hergesell, an international agreement has been secured by means of which kite and balloon ascents are made in several countries on the first Thursday in each month and on three consecutive days during two months of the year. A large station for aeronautical work was recently established at Lindenburg, near Berlin, where kites or balloons are sent up daily for the purpose of securing meteorological records. The greatest height yet reached was during the ascent of the 25th of November, 1905, when by means of several kites sent one after another on the same wire the upper one rose to an altitude of 6430 meters, almost exactly four miles. Owing to want of funds this country could until recently only participate in this work through the individual efforts of Mr. Dines, who received, however, some assistance from the British Association and the Royal Meteorological Society.

The reconstruction of the meteorological office has made it possible now for Mr. Dines's work to be continued as part of the regular work of that office, and further stations are being established. Mr. Cave carries out regular ascents at his own expense at Ditcham Park, and through the cooperation of the

Royal Meteorological Society and the University of Manchester, assisted by a contribution for apparatus from the Royal Society government grant fund, a regular kite station is being established on the Derbyshire moors.

The international committee which collates the observations is a commission appointed by a union voluntarily formed between the directors of meteorological observatories and institutes of countries in which regular observations are taken. The meeting of directors discusses schemes of observations and encourages uniformity.

If I mention a few of the difficulties which stand in the way of a homogeneous system extending over Europe, I do so in the hope that it may perhaps ultimately assist in removing some of them. It is obviously desirable that the charts, which are intended to show the distribution of pressure and temperature, should be derived from observations made at the same hour. Germany observes at 8 o'clock of Central European time, and France observes simultaneously (or nearly so) by choosing 7 o'clock, Paris time, for its readings. We observe at 8 o'clock, Greenwich time, which is an hour later. It is the great desire of continental meteorologists that our standard hour should be 7 o'clock, and what prevents it from being so? Chiefly and absolutely the additional cost which the post-office must claim for the transmission of telegrams; because messages transmitted before 8 o'clock are subject to an additional charge of one shilling, which may be claimed by the postmaster, the claim being possibly increased to two shillings when the postmaster and telegraphist are different persons. This is prohibitive, but it does not exhaust the inconvenience of the additional charge. For the purpose of weather forecasting it is clearly necessary that telegrams should be received as early as possible by the meteorological office. But the 8 o'clock rule delays telegrams from some Irish stations, because 8 o'clock by Dublin time is 8:25 by Greenwich time, and therefore Irish telegrams may have to wait until nearly half past 8 if they are to be transmitted without extra charge.

While the international organization of meteorology is well on its way, though difficulties such as those I have mentioned may temporarily retard it, another question not altogether disconnected with it has been raised by Sir John Eliot. This is the establishment of an institution devoted to the collective study of meteorological problems affecting all parts of the British Dominions. It is true, not only in this but also in other matters, that in order to take our proper position in international work it is necessary that we should set our own house in order, and we must give Sir John Eliot's proposals our hearty support. If I do not enter further into this question, it is because I am now dealing more especially with problems which go beyond the limits of the Empire. I assume the existence of a national organization, but lay stress on the insufficiency of this limitation.

The importance of the subject, however, may be my justification, if I direct attention for a moment to the meteorological question as it presents itself in India. We all know and realize the vital importance of the rainy season, and the benefit which the native population would derive if it were possible to predict, even if only imperfectly, the setting in of the monsoon. It appears that Doctor Walker, the present director of observatories in India, recently obtained very encouraging results in this respect. According to his investigations, a forecast of the monsoon may be derived from a knowledge of the weather during preceding months in different parts of the world. Thus a heavy rainfall in Zanzibar in May is followed by a weak monsoon, while a pressure deficiency in Siberia during the month of March indicates a probable deficiency of rain in India during the following August. I need not insist on the importance of these results, which at present are purely empirical and require further confirmation, but it is quite clear that for the successful prosecution of these inquiries political boundaries must be disregarded and a system of intercommunication organized between the countries chiefly concerned. Doctor Walker informs me that he has successfully arranged for telegraphic reports to be sent to him at the beginning of June from six different stations in Siberia. It is hoped that this cooperation, which was unavoidably discontinued during the late war, may now be reestablished.

The course of international organizations does not always run smoothly. The efforts made toward cooperation in earthquake records have unfortunately led to differences of opinion, which have hitherto prevented a truly international system being formed; and if I give a short historical account of the circumstances which have led up to these differences, it is only in the hope that this may help to remove them. The scientific investigation of earthquakes may be said to have begun when British professors of physics, engineering, and geology were appointed at the Imperial College of Engineering in Tokyo. Some of them on returning home succeeded in interesting the British Association in the subject. Ever since 1880 that association has been an active supporter of seismic investigations. The much disturbed region of the Japanese islands was naturally the first to be studied, but in 1895 Professor Milne, as one of the secretaries of the committee, issued a circular calling attention to the desirability of observing waves which have traveled great distances, and some months later Dr. E. v. Rebeur-Paschwitz, of Strasburg, drew up suggestions for the establishment of an international system of earthquake stations. To this scheme Professor Milne and other members of the British Association committee gave their approval. The cooperation which thus seemed so happily inaugurated was broken by the unfortunate death of its originator. Circumstances then arose which compelled the British Association committee to go its own way. Under its direction a system was established which now includes about forty stations distributed all over the world. But the needs of different countries are not, and were not, meant to be satisfied by this organization.

There is always a certain number of earthquakes having purely local importance and requiring discussion from a purely local point of view. For the purpose of such discussion relating to the disturbances which chiefly affect central Europe, the union, so-called "kartell", of the academies of Vienna, Munich, Leipzig, and Göttingen formed a committee and did excellent work. In the meantime Professor Gerland, who had succeeded Doctor Rebeur-Paschwitz at Strasburg, had personally invited a number of friends interested in the subject to a conference at Strasburg, with the object of forming an international association. This was followed in 1903 by a formal conference called by the German Government, at which Great Britain was represented by Sir George Darwin and Professor Milne. This conference drew up a scheme for an international association, and a large number of countries, including Russia and Japan, joined. Strasburg was selected as the seat of the central bureau. The matter came up for discussion at the meeting of the International Association of Academies, which was held in London in 1904, and a committee was appointed for the purpose of suggesting such modifications in the constitution of the seismic organization as might bring it into harmony with the views of the associated academies. This committee, over which I had the honor to preside, met at Frankfort and recommended a number of important changes, which were unanimously accepted by the second seismic conference, held last summer in Berlin. In consequence of this acceptance, it appears that Italy and the United States joined the seismic association, while England declared its willingness to join under certain conditions, of which the simultaneous adhesion of France was one. The following summary of the States which have joined and their population is copied from the official report of the last meeting at Berlin:

Country.	Population.	Contribution.	Country.	Population.	Contribution.
German Empire	60,000,000	£160	Italy	33,000,000	£160
Belgium	7,000,000	40	Mexico	13,600,000	80
Bulgaria	3,700,000	20	Norway	2,300,000	20
Chile	3,000,000	20	The colonies of the Netherlands	5,500,000	40
Kongo State	19,000,000	80	Portugal	5,400,000	40
Spain	19,000,000	80	Roumania	6,300,000	40
United States	76,000,000	160	Russia	129,000,000	160
Greece	2,500,000	20	Switzerland	3,300,000	20
Hungary	19,250,000	80			
Japan	48,000,000	160			

It was decided at the Berlin meeting that Professor Kövesligethy, of Budapest, should be secretary and Professor Palazzo, of Rome, the vice-president of the International Seismic Association. Professor Gerland had already previously been designated as director of the central bureau. The office of president of the association was left vacant until the final decision of Great Britain as to its adhesion had been settled. There the matter stands for the present.

The disastrous results of recent earthquakes and volcanic eruptions have directed increased attention to the subject. Its thorough investigation is indeed likely to yield important information on the interior constitution of the earth. A hearty cooperation to obtain and circulate the material for a detailed discussion can not fail to bear fruit, and even though there may be legitimate grounds for dissatisfaction at the manner in which a particular scheme has been organized, I must express my own opinion that at the present moment the permanent interests of this country would be best secured by our joining the association and helping to direct its work in a manner which would assist rather than hamper the present organization of the British Association.

THE SPECTRUM OF THE AURORA BOREALIS.

By Dr. W. MARSHALL WATTS. Dated Sydenham, England, September 14, 1907.

Among the rare and striking phenomena of nature, the aurora borealis, or "northern lights", has always excited much interest. The earlier explorers of the Arctic regions made frequent observations of it, and speak of it in glowing terms, describing it as either a long tranquil arc of silver light, stretching along the northern horizon, with its highest point in or near to the magnetic meridian; or as broken cloud-like masses of a glowing ruddy light, with streamers and golden rays, compared to aerial spears, shooting from the arc and sometimes reaching to the zenith, forming an appearance resembling a crown—the "corona borealis".

Upon the invention of the spectroscope scientific observers were eager to apply the new method of investigation to the aurora. Among the earliest observers of the spectrum was Ångström, who, in the winter of 1867–68, observed[1] on several occasions the spectrum of the luminous arc bordering the dark segment, which is always to be seen in the aurora even when faint. Its light proved to be almost monochromatic, and consisted of a single brilliant greenish line to the left of a group of known lines of calcium.

Measuring the distance of the auroral line from this group, Ångström determined its wave length to be 5567.[2] Besides this line, of which the intensity is relatively great, Ångström observed also, by widening the slit, traces of three faint bands extending nearly to *F*. Ångström remarks that this chief auroral line does not coincide with any known line in the spectra of simple or compound gases. Otto Struve, of Pulkowa, to whom Ångström communicated his result, also made measurements, which gave for the position of the line 1259 of Kirchhoff's scale, or wave length 5552.

[1] Ångström: "Recherches sur le Spectre Solaire".

[2] That is, 5567 "Ångström units" or hundred-millionths of a centimeter, or 5567 ten-millionths of a millimeter, or 556.7 micro-millimeters or 556.7 $\mu\mu$, or 0.5567 microns, or 0.5567 μ.—EDITOR.

In a paper of later date[3], Ångström discusses the probable origin of the auroral line, and gives it as his opinion that the spectrum consists of two portions, the chief line being due to phosphorescence (or fluorescence) and the other lines to rarified air, the conditions of temperature and pressure, so different in the upper regions of the atmosphere from those in the laboratory, sufficing to explain all divergencies. He says:

> The one spectrum results from the monochromatic yellow light which is always seen even in the feeblest traces of the aurora, and which, on clear winter nights, is perceived from all parts of the sky. The other spectrum consists of extremely feeble lines or bands, and it is only in the strongest auroras that it is possible to measure their position even approximately. Piazzi Smyth[4] observes that the chief line of the aurora falls between the second and third lines of the greenish yellow hydrocarbon group; and Vogel[5] remarks that it is coincident with a line in the spectrum of rarified air. This latter observation is correct, but in my opinion this is the result of the purest accident. The red lines—first observed by Zöllner—seldom occur. There is no doubt that the spectrum varies at different times. The discharge is sometimes disruptive, and sometimes by conduction; it occurs sometimes in the extreme limits of the atmosphere, and sometimes at short distances from the earth's surface.

Ångström observed (on April 18, 1873) lines at 5567, 521–, 501–, 487–, 472–. He quotes the observations (of presumably the same lines) by Barker[6] as 431–, 4705, by Vogel[7] as 4694, 5233, and Lemström[8] (November 19 and 22, 1872) as 5568, 5235, 4694, 4262, and thinks that the means of these measurements agree fairly well with the lines 5227, 4707 and 4272 observed in the violet light at the negative pole in rarified air.

Vogel[9] observed the auroral spectrum on several occasions in 1870 and 1871. The instrument he used was the star spectroscope belonging to the 11-inch equatorial of the Bothkamp Observatory, consisting of a set of direct vision prisms, with slit, collimator, and observing telescope with a magnifying power of four. The measuring apparatus consisted of a micrometer screw, the head of which was divided into 100 parts. This moved a fine steel point in the field of view, and the point could be illuminated by a small lamp if required. The readings of the micrometer were reduced to wave lengths by means of readings of about 100 Fraunhofer lines found in Ångström's Normal Map of the Solar Spectrum. After each observation of the auroral spectrum readings of the sodium line or of the hydrogen lines were taken by way of control.

A very bright aurora was observed on October 25, 1870. The spectrum showed the green line and several fainter lines toward the blue on a dimly lighted background, extending over *E* and *b*, and half-way from *b* to *F*. No measurements were taken on this occasion.

On February 11, 1871, an aurora was seen; the average of six readings of the brightest line was 5573. No lines in the red were seen. On February 12 an average of six readings gave 5572; Doctor Lohse also took six readings and obtained 5569. The appearance of the spectrum on this occasion was essentially different from that of February 11. The green continuous spectrum was present from 5572 to *b* and traversed by some bright lines between *b* and *F*, one line beyond *F*, and just before *G* a faint broad band. Later a red line between *C* and *D*, but nearer *C* than *D*, made its appearance.

On April 9, 1871, a very bright aurora was seen, showing a red sheath rising nearly to the zenith. The spectrum was similar to that of February 12, but much more intense, showing five lines in the green, and a broad band in the blue. The red ray allowed him to recognize seven lines, for which the

[3] Ångström, Pogg. Ann., Jubelband, p. 424.

[4] Piazzi Smyth, C. R. [Comptes Rendus], LXXIV, p. 597.

[5] Vogel, Pogg. Ann., CXLVI, p. 582.

[6] Barker, American Journal of Science, (3), II, 465; V, 81.

[7] Vogel, Pogg. Ann., CXLVI, p. 573.

[8] Lemström, Polarljuset och Polarljusspektrum. Helsingfors, 1873.

[9] Vogel, Pogg. Ann., CXLVI.

wave lengths (in each case the mean of four readings) were as follows:

6297 ± 14 very bright.
5569 ± 2 the brightest line in the spectrum—becomes fainter on the appearance of the red line.
5390 very faint.
5233 ± 4 moderately bright.
5189 ± 9 very bright when the red line appears at the same time.
5004 ± 3 very bright.
4694 to 4663 a broad band, less bright in the center.
4629 ± 3 very faint in those parts of the aurora in which the red line appears.

On April 14 a faint aurora occurred, only the green line being seen; the mean of two readings was 5569. The probable wave length of the chief line Vogel estimates at 5571.3.

In discussing the observations of the spectrum of the aurora it will be convenient to deal separately with (*a*) the chief auroral line in the greenish-yellow; (*b*) the lines in the red, which are only occasionally observed, and (*c*) the lines at the blue end of the spectrum, which seem to be related to the band spectrum of nitrogen, as seen at the positive or negative pole in a Geissler tube.

Professor Scheiner, in his Treatise on Astronomical Spectroscopy, quotes the following observations of the chief line, as compiled by Gyllenskiöld,[10] to which I have added a few others, with references:

Year.	Observer.	Reading.	Authority.
1867..	Angström.....	5567 ± 1	
1868..	Struve	5552 ± 15	Bull. Acad. St. Petersbourg, xiii, 449.
	Lemström.....	5569 ± 14	Arch. de Genève, (2), l, 225, 355.
1869..	Peirce	5565 ± 11	Am. J., (2), xlviii, 123, 404.
1870..	Proctor	5595 ± 25	Nat. iii, 6; vii, 242.
1871..	Smyth	5579 ± 95	Piazzi Smyth, v. 282, 324.
	Lindsay.....	5680 ± 50	Nat. iv, 347, 366; vii, 182.
	Barker.....	5594 ± 13	Am. J., (3), ii, 465; v, 81.
1872..	Vogel	5571 ± 1	Pogg. Ann., cxlvi, 569.
	Denza.....	5568 ± 12	
	Donati.....	5569 ± 10	
	Oettingen.....	5548 ± 30	Pogg. Ann., cxlvi, 284; Ann. Chim. Phys. (4), xxvi, 269.
	Respighi.....	5574 ± 10	Nat. v, 511; C. R., lxxiv, 743.
	Wijkander....	5572 ± 1	Arch. de Genève, (2), ii, 25.
1873..	Backhouse....	5560 ± 10	Nat. iv, 66; vii, 182, 463; xxviii, 209, 212.
	Barker.....	5569 ± 14	Am. J., (3), ii, 455.
	Lemström.....	5569 ± 5	Arch. de Genève, (2), i, 225, 355.
1874..	Maclear.....	5583 ± 37	Nat, vi, 329; xvii, 11.
	Backhouse....	5570 ± 10	Nat. iv, 66; vii, 182, 463; xxviii, 209, 212.
	Huggins.....	5571 ± 0.5	Proc. Roy. Soc., xlv, 430; xlvi, 133.
1879..	Nordenskiöld.	5563 ± 10	Vega Expeditionens, tome 1.
1880..	Copeland	5572 ± 2	Nat. xii, 510.
1882..	Gyllenskiöld..	5568 ± 2	Aurores Boréales, Stockholm, 1886.
	Schroeter.....	5587	
	Krafft.....	5591	
1884..	Gyllenskiöld..	5569 ± 6	Aurores Boréales, Stockholm, 1886.

The mean of all these measurements is 5569.8, but Professor Scheiner selects the following as the most trustworthy:

Year.	Observer.	Reading.
1867..	Angström.....	5567 ± 1
1872..	Vogel.....	5571 ± 1
	Wijkander....	5572 ± 1
1873..	Lemström.....	5569 ± 5
1874..	Huggins.....	5571 ± 0.5
1880..	Copeland.....	5572 ± 2
1882..	Gyllenskiöld..	5568 ± 2

The mean of these numbers is 5570.0.

This result is, of course, on Ångström's scale; to reduce to Rowland's scale we must add 1.3, thus obtaining for the wave length of the chief auroral line 5571.3.

Eighteen measurements by Professor Campbell at Mount Hamilton[11] gave a mean result of 5571.6.

It is only within recent times that the spectrum of the aurora has been photographed. The first success in this direction was obtained by E. S. King at Harvard College Observatory in 1897.[12] Two photographs obtained on April 1, 1897, and March 15, 1898, with an exposure of 147 minutes showed four lines whose wave lengths are given as 4694, 4288, 3922, and 3862. The strong yellowish-green line does not seem to have been recorded, probably because the plates were insensitive to this region of the spectrum.

Paulsen, in Iceland, obtained photographs of the aurora spectrum in January, 1900. Besides the chief line at 5570 the photographs showed 21 lines between 4700 and 3370. Their wave lengths were determined to be:[13] 470, 463, 456, 449, 443, 436, 432, 422, *420*, 417, 412, 406, 402, 397, 393, *391.5*, 381, 376, 371, *358*, 353, and *337;* those italicized were strong lines, the rest weak. Paulsen remarks that the strong lines seem to belong to a different spectrum from the weak lines. Experiments made later at Copenhagen seemed to show an agreement with the negative-pole spectrum of nitrogen, and Professor Scheiner, to whom the photographs were submitted, writes: "There appears to me no doubt that the auroral spectrum is absolutely identical with the kathode spectrum of nitrogen".

The best photographs of the auroral spectrum hitherto obtained seem to be those of the Russo–Swedish expedition taken at Konstantinovka, Spitzbergen, in the winter of 1899–1900 by Professor Sykora.[14] The instrument employed was a spectrograph (see fig. 1) specially constructed for the purpose with objectives of 110 mm. focus, provided with either a simple prism or a compound Rutherford prism. It was found necessary to expose for many hours or even for several days, and trouble was experienced from variations of temperature during the long exposure resulting in want of definition of the lines. The best results were obtained with the single prism, and five negatives (see fig. 2) were obtained from which measurements could be made. As reference lines the Fraunhofer lines *F*, *G*, and *K* and certain hydrogen lines from a vacuum-tube were adopted. From these the wave lengths of the auroral lines were calculated by means of Hartmann's formula. Negatives 1, 2, and 3 showed only three lines; the other two negatives showed these three and several other lines besides. The following were the values obtained for the three brighter lines:

	Green line.	Violet line.	Ultraviolet line.
No. 1.....	5567.0	4273.1	3912.1
	5573.9	4276.2	3912.4
	5574 6	4276.4	3913.1
Mean.....	5571.8±1.6	4275.2±0.7	3912 5±0.2
No. 2.....	5569.1	4264.7	3911.0
	5589.0	4268.7	3910.7
	5587.2	4268.2	3910.7
	5594.0	4268.7	3911.8
Mean.....	5584.8±3.7	4267.4±0.7	3911.0±0.2
No. 3.....	5558.3	4279.4	3908.0
	5549.8	4279.6	3914.6
	5547.5	4279.2	3914.8
	5548.6	4277.1	3913.7
Mean.....	5551.0±1.7	4278.8±0.4	3912.8±1.1
No. 4.....	5572.6	4275.1	3911.2
	5576.1	4280.5	3911.8
	5569.1	4273.1	3908.1
	5574.3	4275.1	3911.1
	5576 1		3910.5
Mean.....	5573.6±0.9	4275.9±0.8	3910.8±0.3

[10] Gyllenskiöld: "Aurores boréales", Stockholm, 1886; p. 166, in the Swedish Polar Expedition.

[11] Campbell, Astro-Phys. Jour., x, 1897.

[12] E. C. Pickering, Nature, LVII, p. 591.

[13] Exprest in micro-millimeters ($\mu\mu$), instead of the Ångström unit.—EDITOR.

[14] Sykora, Mem. St. Petersb., (8), xi No. 9.

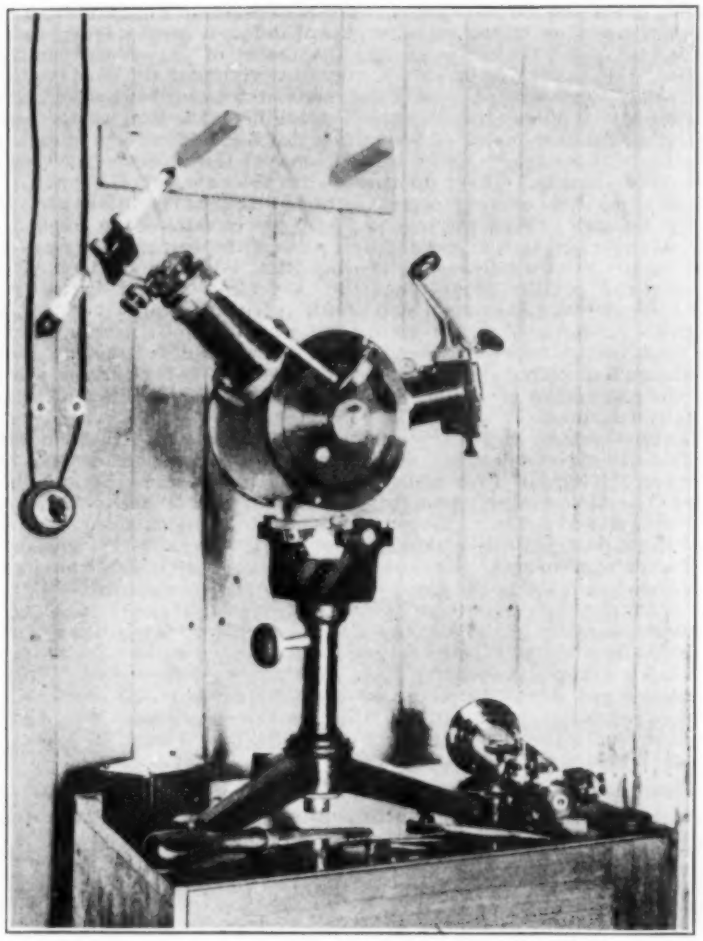

FIG. 1.—Toepfer spectrograph used by Professor Sykora in Spitzbergen, 1899–1900.

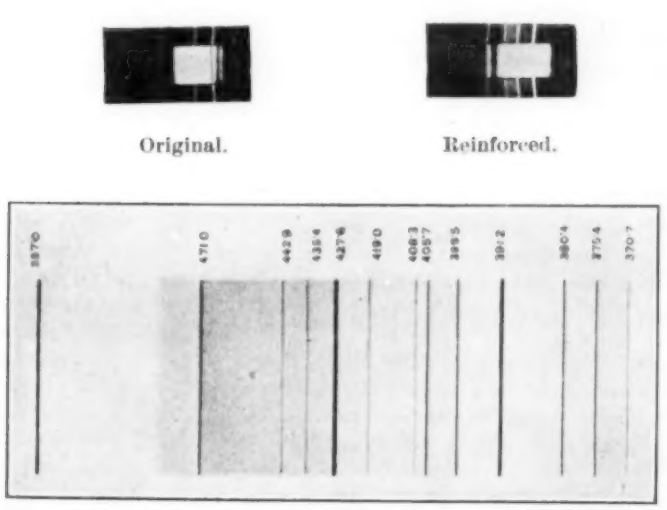

FIG. 2.—Photographic negatives and plot of the spectrum of the aurora by Professor Sykora.

From these means, giving each a weight inversely proportional to the square of its probable error, the following definitive values are obtained:

Green line	5570.3±3.4
Violet line	4274.3±1.6
Ultraviolet line	3911.8±0.3

From these values the wave lengths of the other feeble lines were obtained; negative No. 5 was used only to measure the feebler lines from the first three lines. The final results are given below:

Characteristic green line	5570±3.4
First feeble line	4710±0.5
Second feeble line	4429±1.7
Third feeble line	4354±3.1
Characteristic violet line	4274±1.6
Fourth feeble line	4190±2.3
Fifth feeble line	4083±2.0
Sixth feeble line	4057±0.8
Seventh feeble line	3995±0.8
Characteristic ultraviolet line	3912±0.3
Eighth feeble line	3804±0.8
Ninth feeble line	3754±0.5
Tenth feeble line	3707±0.8

We may, then, sum up our knowledge of the wave length of the chief characteristic green line of the auroral spectrum as follows:

Mean of observations 1867–1882 (Scheiner)	5571.3
Campbell's mean	5571.6
Sykora's mean	5571.8

These numbers present a fair agreement with a strong line in the spectrum of krypton, the wave length of which is given by Baly as 5570.50 and by Runge as 5570.417. Its intensity is given as ten in the first spectrum (without Leyden jar and spark-gap) and three in the second spectrum (with jar and spark-gap).

In the Astrophysical Journal of 1903,[15] Professor Runge writes:

> In his report on the aurora Paulsen compares its spectrum with the bluish light near the kathode of a vacuum tube filled with oxygen and a little nitrogen and carbonic oxide. He concludes that there is a close connection between them.
>
> This conclusion seems to me misleading, since there is quite as striking a coincidence with krypton as with oxygen. These comparisons of spectra have very little value so long as wave lengths of the aurora lines are not measured more accurately. The only aurora line which has been measured with a considerable amount of accuracy is the green line, and here the coincidence seems to be in favor of krypton as I pointed out some years ago.

In the same journal, for April, 1904, Baly,[16] after referring to Runge's paper, writes:

> Sykora's measures are probably at least as accurate as any hitherto published. In the table given below lines are taken from both spectra of krypton. The aurora discharge takes place through very rarefied gas, especially if the atmospheric krypton is the main carrier of the electricity. It has long been known that when the ordinary discharge passes through argon at reduced pressure the red spectrum only is visible, unless the pressure is too low when both the red and blue spectra are seen simultaneously. The same is true of krypton, for when the pressure is greater than a certain small value, only the first krypton spectrum is seen, if the pressure be now reduced a stage is soon reached at which the second (or jar and spark-gap) spectrum makes its appearance, so that the two spectra are seen together. Such a condition might perfectly well obtain in the case of the aurora, and therefore lines are taken from both spectra.

Aurora spectrum (Sykora).	Krypton spectrum.	Intensities.	
		First spectrum.	Second spectrum.
5570, strong	5570.5	10	3
4710, weak	4710.7	.....	1
4429, very weak	4431.8	.....	4
4354, very weak	4355.7	1	10
4276, strong	4274.1	10	2
4190, very weak	4185.3	.....	2
4083, very weak	4082.6	.....	4
4057, weak	4057.2	.....	8
3995, weak	3995.0	.....	6
3912, strong	3913.0	.....	1
	3912.7	.....	5
3804, weak	3804.8	.....	4
3754, weak	3754.3	.....	5
3707, very weak	3708.2	.....	1

There seems hardly any doubt, from the above figures, of the very close connection between the aurora spectrum and the krypton spectra;

[15] Runge, Astrophysical Journal, XVIII, page 381.
[16] Baly, Astrophysical Journal, XIX, page 187.

further, it seems that it is the second spectrum that is most concerned. This is only to be expected if we consider the probable rarefied condition of this gas at the high altitudes at which the discharge takes place.

In endeavoring to reconcile the observations of different observers one is forced to the conclusion that the spectrum varies at different times, and this also is the opinion exprest by Ångström and others. This is conspicuously the case as regards the lines in the red portion of the spectrum. Some auroras are described as "red auroras". The aurora observed in America, November 9, 1871, is described by Barker[17] as "a crimson aurora (with lines at 623, 562, 517, 502, and 482) giving place in half an hour to a white aurora which showed only the last four of these lines". Backhouse[18] says that he has observed the green line in 83 auroras, but the red in only 11.

In attempting to discover the wave length of this red line it seems to be justifiable to correct the measurements by the measurements of the green line made at the same time by each observer to agree with 5570. We have thus the following results:

Observer.	Observed wave length.	Corrected.
Vogel		6297
Piazzi Smyth.	6300—(5579—5570)	6291
Ellery	6350—(5600—5570)	6320
Zöllner		6279
Oettingen	6290+(5570—5548)	6312
Rowland	6283+(5570—5543)	6310
Gyllenskiöld	6306+(5579—5568)	6308
Mean		6302.4
Mean reduced to Rowland's scale		6303.4

There is a strong red line in the spectrum of neon with wave length 6304.99. This identification of the red line with a line of neon seems pretty nearly as satisfactory as the identification of the green line 5571.6, with the krypton line 5570.5.

Sir James Dewar, in a lecture delivered at the Royal Institution in 1902, exprest the opinion that "the rosy tint in the streamers (of the aurora) appears to be due to neon".

We are not able to arrive at satisfactory conclusions as to the origin of the other lines which have been recorded by different observers in the spectrum of the aurora. There is much doubt in the identification of a line as the same line in the different observations. H. R. Proctor, in an article in the Encyclopedia Britannica[19] attempted a summary of the observations then available. Rand Capron, in his book, Auroræ and their Spectra (London, 1879), gave another attempt. A very good summary was given by Backhouse in Nature[20] of 1883. Other attempts are those of Berthelot[21], who sought to identify the lines with those of argon, and Stassano[22], who enumerated as belonging to the aurora more than a hundred lines, of which he identifies two-thirds with lines of the atmospheric rare gases; but it is evident that Stassano has multiplied any one line of the aurora into as many lines as there are observers, so that the comparison can not be considered of much value.

The wave lengths of lines in the accepted auroral spectrum are given in Table 1, and these are compared with spectra of atmospheric gases in Table 2. Fig. 3 gives a graphic presentation of the work of all observers.

Professor Sykora says[23]:

The photographs show that the spectrum of the aurora borealis does not resemble any known spectrum. It is most natural to refer the lines of the aurora to those of nitrogen. According to wave lengths some of the lines seem to agree with lines of nitrogen, but we have too few data to justify a definite conclusion; the more so as the spectrum of nitrogen has numerous lines in the ultraviolet region which, for want of quartz prisms, could not be obtained in our photographs of the aurora. The simple comparison of the wave lengths of different spectra seems to be less important for the explanation of the nature of the aurora than the study of the spectra of rarefied air or nitrogen under the most varied conditions. In taking account of the relations between the aurora borealis, terrestrial magnetism, and the physical life of the sun, we may conclude that the phenomena of the aurora are luminous effects produced in the upper atmosphere under the influence of the electromagnetic induction of the sun. These phenomena are observed, especially in high latitudes, partly in consequence of the meteorological conditions and the purity of the air in these regions, and partly on account of the neighborhood of the magnetic and geographical poles of the earth. The relation between the aurora and terrestrial magnetism is shown by the greater number and greater intensity of the auroras observed in the regions surrounding the north and south poles, and the fact that the magnetic needle is disturbed during the occurrence of auroras. As to the relationships between auroras and the physical life of the sun, they are shown indirectly by the undoubted connection between solar spots and the magnetism of the earth, and directly by the statistics of solar spots and auroras.

The how and the why of the production of auroras are still unknown. All that can be asserted is that we have to do with a phenomenon resembling the light of a rarefied gas produced by electromagnetic induction in the anelectrogenic tube (without ordinary electrodes). We know that the rarefied gas in a tube may be rendered luminous not only when the tube is provided with electrodes, but also in their absence, as shown by Tesla's experiments. It would be of the greatest interest to make experiments similar to those of Tesla, and to study the spectra of nitrogen in the anelectrogenic tube by means of quartz prisms or a concave diffraction grating. That such experiments might lead to results appears probable from the fact that the spectrum of nitrogen at the negative pole differs from that of the positive pole. Among the other conditions under which the gas might be placed, we mention here only the great variations of temperature and density, which, as the experiments of Lockyer, Scheiner, and others show, may influence the character of the spectra obtained, and the position of the lines.

There seems now little doubt that the chief line of the aurora, i. e., Ångström's green line, must be assigned to krypton, and there is considerable probability that the red line is due to neon. What is difficult to understand, on this hypothesis,

TABLE 1.—*Wave lengths of lines in the accepted auroral spectrum as determined by various observers.*

Proctor.	Capron.	Backhouse.	Paulsen.	Gyllenskiöld.	Sykora.	Mean.
6303	6297	6289		6306		6299
				5776		5776
				5664		5664
5569	5567	5569.7	5570	5569	5570	5570
	5390 (?)					(?)
5342		5339		5353		5351
		5285				5285
				5264		5264
	5233	5237				5235
		5226		5228		5227
5214		5199				5206.5
	5189					5189
5161						5161
	5004	5001		5001		5002
4984						4984
		4870				4870
	4835			4837		4836
4823						4823
			4700	4707	4710	4706
	4694	4688				4691
4667	4663					4665
				4642		4642
	4629		4630			4629.5
			4560			4560
			4490			4490
			4430		4429	4429.5
		4366	4360			4363
	4350				4354	4352
			4320			4320
4299						4299
		4278			4276	4277
			4220			4220
			4200		4190	4195
			4170			4170
			4120			4120
					4083	4083
			4060		4057	4058.5
			4020			4020
					3995	3995
			3970			3970
			3930			3930
			3915		3912	3913.5
			3810		3804	3807
			3760		3754	3757
			3710		3707	3708.5
			3580			3580
			3530			3530
			3370			3370

[17] Barker. American Journal of Science, (3), ii., p. 465.
[18] Backhouse. Observatory at the Observatory. Sunderland. Vol. II.
[19] Ninth edition, Vol. III, p. 90.
[20] Vol. XXVIII, p. 209.
[21] C. R., March, 1898.
[22] Ann. Chim. et Phys., (7), XXVI, p. 40.
[23] Sykora, Mem. St. Petersburg, (8), XI, No. 9.

TABLE 2.—*Wave lengths of spectrum lines for the aurora and for certain atmospheric gases.*

Aurora.	Neon.	Krypton I.	Krypton II.	Nitrogen.	
				Band.	Line.
6299	6305 (8)				
5776	5764.5 (8)				
5664	5663 (1)				
5570		5570.5 (10)	(3)		
5351					
5285					
5264					
5235					
5227			5229.7 (1)		
5206.5			5208.5 (3)		
5189	5188.8 (1)		5187.2 (1)		
5161					
5002					{5005.7 / 5002.7} (10)
4984			4982.9 (1)		
4870			4870.2 (1)		
4836	4837.5 (1)		4836.7 (2)		
4823			4825.4 (3)		
4705.7	4704.6 (4)		4710.7 (1)	4709.3	
4691		4691.1 (2)	4691.5 (2)		
4665				4666.3	
4642				4648.4	
4629.5		4624.5 (10)			
4560			4556.8 (4)	4555.2	
4490			4490.0 (4)	4489.6	
4429.5	4430.3 (1)		4431.8 (4)		
4363			4362.8 (9)	4356.3	
4352		4351.5 (3)	4355.7 (10)		
4320		4319.8 (10)	(1)		
4299			4300.7 (5)		
4277		4274.1 (10)	(2)	4269.1	
4220			4222.4 (1)	4239.0	
4195	4198.7 (4)		4185.3 (2)	4200.8	
4170			4172.0 (2)	4141.2	
4120			4118.3 (2)		
4083			4082.6 (5)	4094.0	
4058.5			4057.2 (8)	4059.0	
4020					
3995			3995 (6)	3998.0	
3970			3965.0 (4)		
3930			3929.3 (3)	3942.5	
3913.5			3912.7 (5)	3913.7	
3807			3804.8 (4)	3804.8	
3757	3754.3 (2)		3754.3 (5)	3755.1	
3708.5	3701.3 (6)		3708.2 (1)	3710.1	
3580			3580.1 (1)	3581.5	
3530	3329.9 (1)		3535.5 (6)	3536.5	
3370	3370.0 (6)		3375.1 (4)	3371.2	

is why the other strong lines of krypton and neon are not also seen. It is reported[34] that at the soirée of the Royal Society in 1901 Sir W. Ramsey exhibited an "artificial aurora", and said: "An electrodeless discharge in air gives a spectrum in which the leading green line of krypton is distinctly visible at low pressures. The discharge was deflected by the magnet, sending out streamers along the lines of magnetic force."

Among other experiments bearing upon this question may be mentioned those of Liveing and Dewar[35] on the spectrum of the most volatile gases of the atmosphere, not condensed at the temperature of liquid hydrogen. A vacuum-tube filled from liquid air after passing thru liquid hydrogen so as to condense nitrogen, oxygen, argon, and carbonic acid gave a brilliant spectrum of hydrogen, helium, and neon, and a large number of less brilliant lines. There was no line observed in the neighborhood of 5570.

Moissan and Deslandres[36] found that in a vacuum-tube containing air when exhausted to pressures less than one millimeter the nitrogen spectrum became weaker, and other lines became more prominent, especially the argon line at 4158.6 and the helium line at 4143.7.

Sir James Dewar, in a lecture delivered[37] at the Royal Institution in November, 1903, has dealt with various problems of the atmosphere. Dalton's theory assumes that each constituent of the air forms a separate atmosphere, completely independent of the other constituents except for temperature; and thus, if we fix an altitude and assume the rate of fall of temperature as known, we can calculate the pressure of each constituent for that altitude and thus calculate the composition of the atmosphere at that altitude. If, at the surface of the earth, the air contains one volume of hydrogen in 10,000, then at an altitude of 37 miles we should find that water vapor and carbonic acid had disappeared and that the air contained about 12 per cent of hydrogen and only 10 per cent of oxygen; and at 47 miles, where the temperature might be —132° C., only hydrogen would be left.

The aurora has been observed at very different heights varying from a few hundred meters to several tens of kilometers, of which altitudes the lower are most frequently observed in the Arctic regions. With increasing altitude the temperature of the air must decrease down to the absolute zero, and at extreme elevations we must reach a point where the different constituents of the air would condense.

In a bath of liquid air argon, krypton, and xenon are condensed, and neon and helium become dissolved in the liquid. The denser gases will accumulate in the lower strata, and the lighter gases in the higher strata. From its low density and relatively greater abundance we should expect neon to manifest itself in the highest strata of the atmosphere.

Table 3 gives us useful data in considering this question.

TABLE 3.—*Data relating to certain gases of the atmosphere.*

Gas.	Approximate quantity in 10,000,000 volumes of air at earth's surface.	Density.	Boiling point—absolute scale.	Freezing point—absolute scale.
			°	°
Nitrogen	7,711,600	14	91	
Oxygen	2,065,900	16	80	
Hydrogen	1,000	1	21	15
Helium	15	2	6	
Neon	150	10	34	
Argon	92,300	20	86	82
Krypton	10	40	121	104
Xenon	5	64		
Carbon dioxide	3,360	22	195	

It appears probable that at the requisite great elevation we should have strata of mist consisting of the solidified constituents of the atmosphere.

The writer has made certain experiments to discover what might be expected to be the effect of a conducting layer interposed at a certain height between the negatively electrified surface of the earth and the positively charged upper atmosphere.

For this purpose a brass sphere one and one-half inches in diameter was taken and a glass tube 12 inches long, into which the brass ball would just fit. The glass tube was converted into a vacuum tube and connected to a Fleuss pump; when exhausted to a pressure of seven millimeters, with a kathode at the bottom and anode at the top, the tube gave the usual discharge with the violet glow about the kathode, of which the spectrum showed the characteristic negative-pole spectrum of nitrogen, recognized in particular by the characteristic band at 3913.7, whilst the greater part of the tube was occupied by the brick-red positive column.

The experiment was now interrupted, the tube dismounted and the brass ball inserted, being supported at a point about two-thirds of the height by a short tube of glass fitting inside the larger one, and the tube again exhausted. It was then seen that the ball gave rise to a new kathode and anode spectrum within the tube, discharging negative electricity upward and positive electricity downward. Fig. 4 is a photograph of the discharge within the tube, and Fig. 5 shows the spectroscopic analysis of the discharges, the characteristic negative spectrum of nitrogen being seen at the bottom kathode and also at the top of the brass ball, and the usual positive pole spectrum being seen at the top of the tube, and also below the brass ball. This latter figure is a photograph of the discharge taken thru a Thorp transparent diffraction grating.

[34] Nature, LXVI, p. 204.
[35] Proc. Roy. Soc., LXVII, p. 467 (1901).
[36] Comptes Rendus, CXXVI, p. 1689.
[37] See Monthly Weather Review, January, 1904, Vol. XXXII, pp. 10–12.—EDITOR.

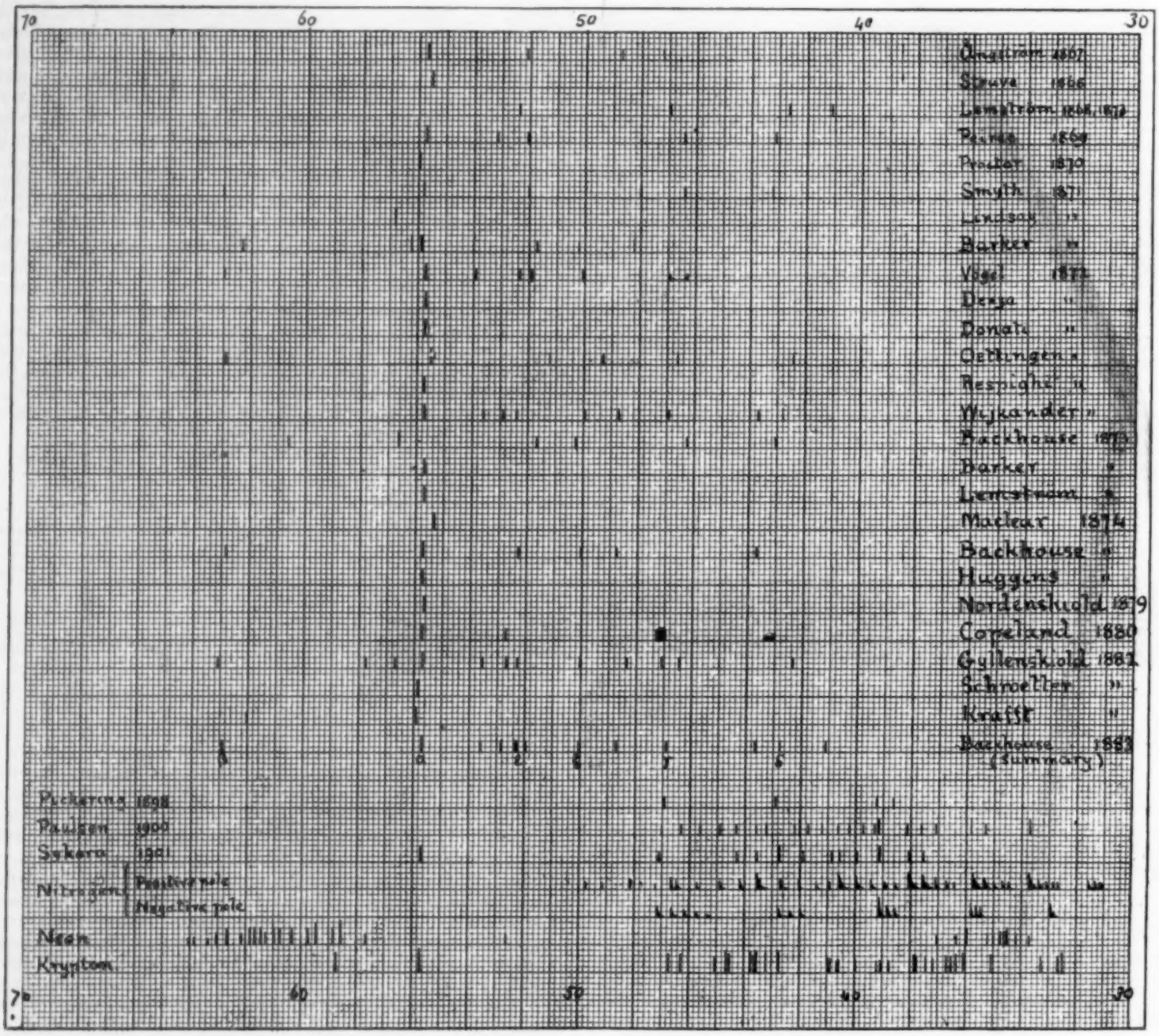

FIG. 3.—Auroral spectrum and gaseous lines as recorded by various observers.

The behavior of the discharge in the tube was observed whilst the pressure of the gas was varied. An ordinary vacuum tube filled with air shows the brightest nitrogen band spectrum at a pressure of a few millimeters; as the pressure increases the band spectrum gradually fades and gives place to the second spectrum of nitrogen with characteristic lines at 5005.7 and 5002.7, and when the pressure reaches about 300 millimeters the band spectrum has disappeared. If the pressure is further increased the second spectrum of nitrogen becomes brighter, until with increase of pressure the spark refuses to pass.

In the experiment with the brass ball it was found that at one particular pressure the band spectrum was seen in the upper and smaller compartment of the tube, whilst the lower compartment was not luminous. It would seem that at this pressure the electricity past by conduction thru the lower compartment sufficiently to produce luminosity by discharge in the upper one. It seems possible that the conducting stratum of condensed gases at a certain height above the earth may play the same part in the auroral discharge as the brass ball plays in the experiment described. There is difficulty in propounding any theory of the auroral discharge which will apply both to auroras observed at low elevations and also to those which have been observed at elevations of 400 or 500 kilometers; since at these extreme heights ordinary electrical discharges would be impossible.

In the reports of results obtained by the Danish polar expedition of 1882–83, the late Professor Paulsen, in an article [28] "Sur la nature de l'aurore polaire" seems to think that the observed facts of the aurora are fairly in agreement with Edlund's theory of atmospheric electricity. He writes:

M. Edlund's theory [29] of the origin of the aurora is based upon the well-

[28] Exploration internationale des regions arctiques. Expedition danoise.

[29] Recherches sur l'induction unipolaire. Kongl. Svenska Vetenskaps akademicus Handlingar, vol. XVI.

known phenomenon of unipolar induction. M. Edlund has shown that in consequence of the diurnal rotation of the earth, the terrestrial magnetism produces a difference in electric potential between the surface of the earth and the upper layers of the atmosphere, the latter being positively electrified, and the surface of the earth negatively. The force of induction which produces this difference of potential is always at right-angles to the direction of the dip needle. In the equatorial regions of the earth this force is vertical, whereas in other latitudes it may be resolved into a vertical force, and a horizontal force. The vertical component tends to propel positive electricity into the upper regions of the atmosphere. In high northern latitudes the same effect is produced by the vertical component, but the horizontal component propels it toward the magnetic zenith. In this way the upper atmosphere accumulates positive electricity of which the potential increases from the equator toward the polar regions.

In the equatorial regions the vertical force offers a great resistance to the reunion of the positive electricity of the air and the negative electricity of the earth. As we approach the poles, the vertical component of the force of induction decreases, and with it the resistance to the flow of positive electricity toward the earth.

When the difference in electric potential between the atmosphere and the earth reaches such a point that the tension can overcome the resistance opposed by the force of induction and the subjacent layers of air, the positive electricity of the air will flow, following the direction of the dip needle, to unite with the negative electricity of the earth. M. Edlund shows by calculation that the regions where such a flow can take place form a continuous zone embracing both the terrestrial and the magnetic poles of the earth, and reaching a lower latitude in America than in the old continent. According to M. Edlund's theory it is to the flow of these currents thru the rarefied air that the aurora borealis is to be attributed.

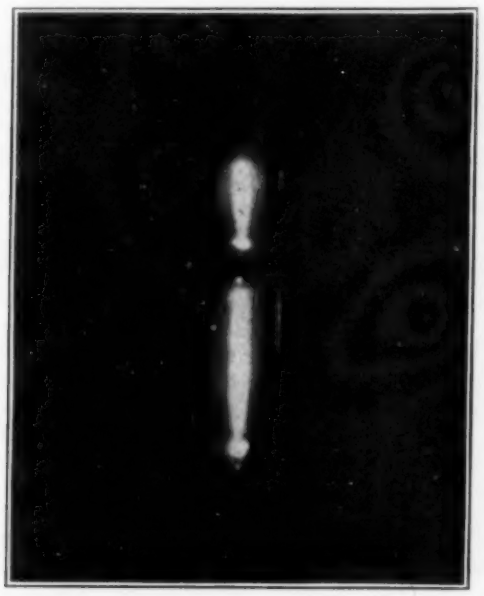

FIG. 4.—Electric discharge within a vacuum-tube containing a brass sphere.

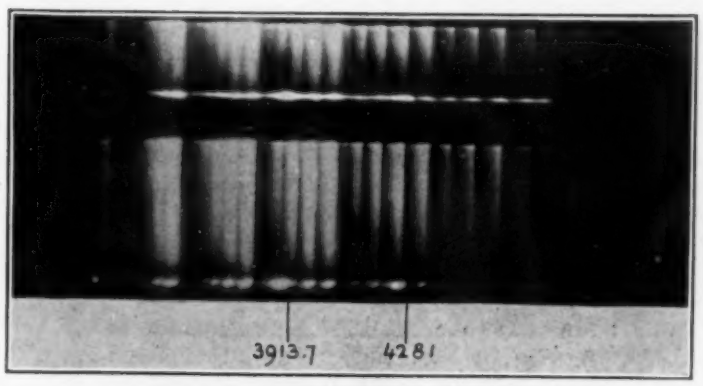

FIG. 5.—Spectroscopic analysis of the electric discharge.

In later papers Paulsen[30] regards the aurora as due to kathode rays, produced by solar agency in our atmosphere, and in fact no theory can be considered complete which does not take account of the statistical correspondences between auroras, sun spots, magnetic storms, etc.

In 1894 Paulsen[31] writes:

An impartial consideration of the phenomena of the aurora leads to the conclusion that we have to do with energy propagated by means of radiation. The source of the radiation can not be in the aurora itself. We can not suppose that an auroral ribbon of almost insensible thickness suspended often at a small height from the earth should be the center of an activity emitting rays darting upward to a height of a hundred kilometers. When a form of energy is propagated by radiation the rays are only the channels by which the source loses its energy. Many of the auroras preserve their radiant structure right up to the base of the phenomenon. How are we to imagine a source of energy animated by a movement surpassing that of the most violent hurricanes possessing the remarkable property of emitting vertical luminous rays as far as the limits of the atmosphere without losing energy in other directions? And how can we explain the origin of an energy having its center of action in the midst of the atmosphere, often in its lower parts, producing the grand phenomena of the aurora borealis, without that energy ever becoming exhausted? We must then admit that the source of emission of the auroral rays is to be sought in the upper regions of the atmosphere, or outside of it; but in any case the constant direction of the rays shows us that the source must participate in the diurnal rotation of the earth.

In radiation the energy is propagated without loss unless the radiation is absorbed by the medium which it traverses. It is only as the auroral rays penetrate into the denser portions of the atmosphere that their traces become visible by absorption and transformation of their energy into light. We are thus led to consider the aurora as a fluorescent light produced by the absorption of energy propagated by radiation, of which the source is found in the upper regions of the atmosphere.

The electric radiation of the negative pole in an exhausted tube presents many analogies with the radiation which produces the aurora. We know that these kathode rays travel in straight lines, without reference to the position of the positive pole, and that they produce fluorescence when they impinge upon the walls of the tube. We know that these rays may penetrate air at atmospheric pressure, being then absorbed with production of light. The passage of these rays modifies the molecular condition of the air, rendering it a conductor.

As to the region of the auroral radiation we must admit the existence of a stratum of negative electricity in the upper regions of the atmosphere. The existence of negative electricity on the surface of the earth is generally admitted. The removal of electricity by rising vapor of water will tend to diminish the potential of the air near the surface of the earth. This action being greatest in the equatorial regions, the mean potential of the air ought to be greatest in the polar regions, and least in the equatorial regions, whereas the exact opposite is the case; and this is to be explained only by supposing an accumulation of negative electricity in the upper regions of the atmosphere toward the poles. The auroral radiation which we suppose is emitted by molecules charged with negative electricity produces a loss of energy which, in accordance with the law of the conservation of energy, can only take place by means of energy supplied to the electric layer from without. It can hardly be doubted that the origin of this energy is solar. The observation that the auroral activity has its maximum in the early hours of the night, and diminishes during the night, suggests that the source of energy has to be renewed each day.

The auroral radiation results from energy stored up in the electric layers. If this storing up of energy is greater in the equatorial regions it does not follow that the transformation of potential energy into actual energy by means of auroral radiation will also be greater in the equatorial regions, if in consequence of movements in the upper atmosphere we suppose these insolated molecules carried toward the poles, there to lose their stored-up energy under the form of auroral radiation. The zone of auroras will be found where this transformation takes place most actively; beyond this zone the energy has diminished, and auroras will be less frequent.

The situation of this zone thus depends upon the movements of the upper atmosphere. It may be an accident that it includes the magnetic pole, but it is possibly not an accident that its central axis coincides with the axis of low atmospheric pressure which extends from the south point of Greenland toward Spitzbergen.

An important paper by Arrhenius[32] appeared in 1900, in

[30] 1906. Sur les recentes theories de l'aurore polaire. Résumé et critique des theories de MM. Birkeland, Arrhenius, et Nordmann. Idées personnelles. (Academie royale des sciences et des lettres de Danemark. Extrait du bulletin de l'année, 1906. No. 2.)

[31] "Sur la nature et origine de l'aurore polaire." Bull. Ac. Roy. Copenhagen, 1894.

[32] Physikalische Zeitschrift, 1900, Vol. II, pp. 81 and 97.

which he pointed out the possibility of a discharge of negatively electrified particles from the sun, which form nuclei of condensation, of which the earth receives its share on the side turned toward the sun.

Maxwell, in his original presentation of the electromagnetic theory of light, in 1873, pointed out that light should exert a pressure, and showed how to calculate its amount. He found that sunlight at the earth's surface should exert a pressure of 0.592×10^{-10} grams on one square centimeter, a quantity so small that it would seem to be hopeless to observe it. Nevertheless Poynting thinks he has obtained experimental proof of the existence of such a pressure. At the surface of the sun a cubic centimeter of water, which on the earth weighs one gram, would weigh 27.47 grams, and the pressure of sunlight on a square centimeter would amount to 2.75 milligrams. Such a mass would be attracted to the sun, but the case is quite different with bodies of extreme minuteness. A cube of water whose edge measures one-thousandth of a millimeter [a micron or μ] would experience an attraction of 27.47×10^{-12} grams and the pressure of light on its side would be $2.75\times10^{-3}\times10^{-8}=27.5\times10^{-12}$, or rather more than its weight. If, then, the cube has smaller dimensions than 1μ it will be repelled. The diameter of a molecule of hydrogen is possibly about 0.0002μ, and this contains perhaps 2000 "corpuscles". Negatively electrified ions of this order of magnitude are given off as kathode rays from the negative pole in a highly exhausted tube, from substances upon which kathode rays impinge, from hot bodies, and from radioactive substances; and these ions are capable of producing fresh ions by collision with the molecules of the gas thru which they pass.

Professor Poynting remarks that "one effect of this radiation pressure worthy of note would be its sorting action on dust particles. If the particles in a dust cloud circling round the sun are of different sizes or densities, the radiation accelerations on them will differ. The larger particles will be less affected than the smaller, will travel faster round a given orbit, and will draw more slowly in toward the sun. Thus a comet of particles of mixed sizes will gradually be degraded from a compact cloud into a diffused trail lengthening and broadening, the finer dust on the inner and the coarser on the outer edge".

A good account of Arrhenius's theory as applied to the explanation of comets' tails, the aurora, etc., has been given in the Popular Science Monthly, Vol. LX, p. 265, New York, 1902, by Prof. John Cox, of McGill University.

With reference to the aurora, Professor Cox says:

> Perhaps the most interesting application of Arrhenius's theory is his explanation of the aurora. In a well-known experiment the streams of negative particles forming kathode rays in a Crookes tube are exposed to a magnetic field, when they are seen to describe helices round the lines of force. If the field is powerful enough they may thus be bent into a complete circle inside a moderately large tube.
>
> Now the negative particles discharged from the sun arrive most thickly over the equatorial regions of the earth, which are most directly opposed to him. Long before they reach any atmosphere dense enough to excite luminescence, they are caught by the lines of force of the earth's magnetic field, which are horizontal over the equator, and have to follow them, winding round them in helices whose radii are so much less than their height above us that the effect to a beholder on the earth is as if they moved *along* the lines of force. Over the equator there is little luminescence for want of atmosphere. But as the lines of force travel north and south they dip downward, making for the magnetic poles, over which they stand vertical. Soon the particles find themselves in lower layers of the atmosphere, comparable in density with our highest artificial vacua, and begin to give out the darting and shifting lights of the kathode ray. But this can only be at the cost of absorption, and by the time the denser layers of air are reached their energy is exhausted. Hence the dark circles round the magnetic poles from which, as from behind a curtain, the leaping pillars of the aurora rise. From this point of view it is significant that Dr. Adam Paulsen, who has made a special study of the Northern Lights, found so many points of correspondence between them and kathode rays that in 1894 he was led to regard the aurora as a special case of the latter, tho unable to give any account of their origin in the upper atmosphere, such as is supplied by Arrhenius's theory.

In communicating the above article Mr. W. M. Watts makes the following appeal to American meteorologists:

> I have come to the conclusion that it is most desirable that other and more accurate observations of the spectrum of the aurora should be obtained. I would respectfully suggest that the duty of obtaining such rests chiefly with you Americans, since your opportunities are, no doubt, greater than ours. Simple arrangements seem to me quite sufficient. In the first place choose a locality away from the lights of a town, preferably on an elevation. I should propose to construct a light observatory, or dark room, of wooden framework, mounted so as to revolve horizontally on a support, so as to oppose the slit side to the brightest part of the aurora. In one wall I would have a vertical slit, and outside of this the largest lens I could obtain for the purpose of concentrating the light upon the slit. This lens need not be achromatic, and, therefore, need not be costly. Inside I would have ready the photographic apparatus, and would supplement the photographic attempts by eye observations of the spectrum at every opportunity. For these eye observations I should choose my binocular spectroscope with large gratings. For the photographs I should use a spectrograph, consisting of a Thorp (or Wallace) grating as large as could be obtained, in front of a lens (telescope) of sufficient aperture to correspond to the grating, and of about 15 inches focal length; and last, but not least, I should use Wratten and Wainwright panchromatic plates.
>
> Measurements of wave lengths are easily made with my binocular spectroscope. I have two different arrangements for the purpose, but in the case of the aurora I should place a nitrogen (or other) vacuum tube so as to occupy a portion of the slit—such vacuum tube being illuminated at will by means of a switch at the observer's position.

Altho such great institutions as the Carnegie Observatory on Mount Wilson, the Lick Observatory on Mount Hamilton, the Yerkes Observatory at Williams Bay, the Harvard College Observatory at Cambridge, and Mount Weather station at Bluemont, may have all the apparatus and men needed for the above-mentioned research, yet the help of others favorably located is still greatly to be desired. The outfit above recommended by Mr. Watts is not expensive as compared with the outfits for many other researches, but the work must be carried out by expert physicists such as are now found in every university.—EDITOR.

SMITHSONIAN METEOROLOGICAL TABLES.

The steady demand for the Smithsonian Meteorological Tables has justified the preparation of a revised edition, dated December, 1906, which is essentially a revision of the edition of 1893, prepared by the late Mr. George E. Curtis, as replacing the previous editions by Guyot, Libbey, and others.

The new edition of 1906 contains an introduction, followed by tables that are classified as thermometric, barometric, hygrometric, wind, geodetical, conversion, and miscellaneous. Among the new or enlarged tables we note the following:

Marvin's pressure of aqueous vapor at low temperatures—English and metric measures.

Bigelow's standard system of notation—formulas and constants.

Hanzlik's list of meteorological stations thruout the world, with their latitudes, longitudes, and altitudes.

Fergusson and Clayton's revision of international meteorological symbols, cloud notation, and cloud definitions.

The Beaufort notation for the use of navigators at sea.

The acceleration of apparent gravity on the earth.

The total number of pages (lx, 280), as compared with that in the revised edition of February, 1896, Smithsonian Miscellaneous Collections, 1032 (lix, 274), shows that the changes have been very conservative. The volume as a whole is a monument to the practical aspects of the work of the Smithsonian Institution.

KITE FLYING FROM MOUNTAIN TOPS.

In his address, October 28, 1907, at the opening of the Aeronautical Congress in New York, N. Y., the president, Prof. Willis L. Moore, referred to the Weather Bureau kite work, as follows:

The United States Weather Bureau at its observatory on Mount Weather, Va., began the systematic exploration of the upper air with kites on June 20 of the present year. Since that time ascents ranging from one to four miles above the station have been made daily, except on Sundays and holidays. On October 3, 1907, an altitude of 23,111 feet above sea level, or a little over four miles above the station, was reached, this being, so far as known, the greatest elevation hitherto reached with kites. At the above-named height the temperature was found to be 5.4° F. below zero. The details of this remarkable flight will be communicated to this Congress by Dr. Wm. R. Blair, of the Mount Weather staff.

The valuable information secured by the kite observations is telegraphed daily to the Central Office of the Weather Bureau in Washington, and is there used in the forecast service for the Middle Atlantic and New England States.

Meteorological stations on Pikes Peak and on Mount Washington in the United States, and on Ben Nevis, in Scotland, have been abandoned, especially as the data secured at those places were found to be of little or no use in the making of weather forecasts, largely because of the disturbing influence of radiation from the mountain itself; but now that the kite has been developed to such a high state of efficiency that at Mount Weather but one observation was mist in three months, it will be possible to reopen these stations and get readings of instruments far above the peaks, which will be more useful to the weather forecaster than any surface observations.

COLLIERY EXPLOSIONS AND BAROMETRIC PRESSURE

Many years ago the English Commission on Prevention of Explosions in Collieries, showed that the combustible gases escape from every crack and crevice into the mine most freely when the external barometric pressure is falling and lowest. The escape diminishes as the barometer rises, and is at its minimum when the pressure is highest. Therefore our ordinary range of pressure (1 inch either side of the average) is an important matter to the miner and the "lows", or storm centers, are still more important.

The London weather predictions always mention the approach of "falling barometer", and the mining industries take proper precaution. In the United States we forecast the approach of a storm center and mention rain, wind, and temperature without using the specific words "low barometer" or "falling pressure", since this is the regular feature of the storm center or "low".

However, local and general forecasters might do well to include this word in their messages to coal mining districts, so that there be no reason to accuse the Weather Bureau of neglecting their interests.

The "fire damps" or combustible vapors and gases are always present in coal mines and the miner who strikes a match, or strikes a spark with his pick, or carries an unprotected light runs an awful risk. The Davy lamp is still the miner's best friend; but even this should not be carried into poorly ventilated mines during very low barometric pressures.

RECENT ADDITIONS TO THE WEATHER BUREAU LIBRARY.

H. H. KIMBALL, Librarian.

The following titles have been selected from among the books recently received, as representing those most likely to be useful to Weather Bureau officials in their meteorological work and studies. Most of them can be loaned for a limited time to officials and employees who make application for them.

Aachen. Meteorologisches Observatorium.
Die öffentliche Wetterdienststelle Meteorologisches Observatorium Aachen. Auf der Wanderausstellung der Deutschen Landwirtschafts-Gesellschaft Düsseldorf 1907 ... Aachen. 1907. [13] p. f°.

Allahabad. Meteorologist.
Administration report ... 1906–7. Allahabad. 1907. 4 p. f°.

Bates, D. C.
The climate of New Zealand. Wellington. 1907. 7 p. 8°.

Bulgaria. Institut météorologique central.
Bulletin sismographique. No. 1. Sofia. 1907. 56 p. 8°.
Same. No. 2. Sofia. 1907. 34 p. 8°.
Tremblements de terre en Bulgarie. No. 7 .. 1906. Sofia. 1907. 56 p. 8°.

Fitzner, Rudolf.
Die Regenverteilung in den deutschen Kolonien. Berlin. 1907. iv, 115 p. 8°.

Grablowitz, G.
Weltkarte der Azimute und der Entfernungen für Hamburg. Laibach. 1907. 3 p. 8°.

Mauritius. Royal Alfred observatory.
Results of the magnetical and meteorological observations ... 1905. London. 1907. xxxiii, lxv p. f°.

Prussia. Königl. preussisches meteorologisches Institut.
Ergebnisse der Niederschlags-Beobachtungen im Jahre 1904. Berlin 1907. lii, 162 p. f°.

Roumania. Institutul meteorologic al Romaniei.
Analele. Tomul XVIII, Anul 1902. Bucuresti. 1907. v. p. f°.

St. Petersburg. Observatoire Constantin.
Étude de l'atmosphere. Fascicule II. Sondages aériens par cerfs-volants en 1902 et 1903 et par ballons en 1901, 1902 et 1903, exécutes à Pavlovsk et à St. Pétersbourg. St. Pétersbourg. 1906. ix, (45), 92 p. f°.

St. Petersburg. Université. Cabinet de géographie physique.
Travaux. 3me fasc. St. Pétersbourg. 1906. 121 p. f°.

Shaw, W. N.
Air currents and the laws of ventilation ... Cambridge. 1907. x, 94 p. 8°.

Ziegler polar expedition 1903-1905.
Scientific results obtained under the direction of William J. Peters ... Edited by John A. Fleming. Washington. 1907. vii, 630 p. f°.

RECENT PAPERS BEARING ON METEOROLOGY.

H. H. KIMBALL, Librarian.

The subjoined titles have been selected from the contents of the periodicals and serials recently received in the Library of the Weather Bureau. The titles selected are of papers or other communications bearing on meteorology or cognate branches of science. This is not a complete index of the meteorological contents of all the journals from which it has been compiled; it shows only the articles that appear to the compiler likely to be of particular interest in connection with the work of the Weather Bureau. Unsigned articles are indicated by a ——

American journal of science. New Haven. 4 ser. v. 24. Oct., 1907.
Barus, C. Successive cycles of coronas. p. 309–312.

Meteorological society of Japan. Journal. Tokyo. 26th year. Aug., 1907.
Akakura, K. The temperature of sea water in the harbor of Yokohama. (Jap.)
Okada, T. On the velocity of a falling raindrop (in English).

Nature. London. v. 76.
—— Meteorological observations. (Sept. 12, 1907.) p. 509.
—— International seismological congress. (Sept. 19, 1907.)
—— The Kingston earthquake. (Sept. 19, 1907.) p. 535.

Science. New York. New series. v. 26. Oct. 18, 1907.
—— Influence of forests upon wind velocity. [Abstract of article by Murat.] p. 518.

Scientific American. New York. v. 97.
—— A remarkable acoustic phenomenon. (Oct. 19, 1907.) p. 279. [Abstract of a paper by Alippi on "brontidi".]

Scottish geographical magazine. Edinburgh. v. 23. Oct., 1907.
Brown, Charles W. The Jamaica earthquake. p. 535–543.

Terrestrial magnetism. Baltimore. v. 12. June, 1907.
Homma, Y. Distribution of electricity in the atmosphere. p. 49–72.
Dike, P. H. Paulsen's résumé of recent theories of polar lights. [Abstract of paper by Paulsen.] p. 84–86.

Aérophile. Paris. 15 année. Août 1907.
Rotch, A. Lawrence. Les conditions météorologiques au-dessus de Saint-Louis et le Coupe Gordon-Bennett. (16 juil. 1907.) p. 223–245.

Ciel et terre. Bruxelles. 27 année.
Dubois, Eug. Quelle est l'importance du transport atmosphérique de sel marin? p. 223–245.
—— Les "bandes d'ombre" des éclipses totales de soleil. [Abstract of memoir by E. Holmes, with discussion.] p. 250–252.
Dobrowolski, A. Les cristaux de glace aériens et le phénomène des halos. (16 sept. 1907.) p. 336–342.

France. Académie des sciences. Paris. Tome 145. 16 sept. 1907.
Nodon, Albert. Observations sur l'action électrique du soleil et de la lune. p. 521–523.

Revue néphologique. Mons. Sept. 1907.
Mémery, Henri. Nuages, pluies, incendies. p. 161–162.
Bracke, A. Direction des nuages à Munich. II. Les cirro-cumulus et alto-cumulus. p. 162–164.
Shedd, J. S. L'évolution du cristal de neige. p. 164–166.

Annalen der Hydrographie und maritimen Meteorologie. Berlin. 25 Jahrgang. Heft 9. 1907.
—— Die Forschungsreise S. M. S. "Planet". p. 388–390.
Mecking, L. Die Treibeiserscheinungen bei Neufundland in ihrer Abhängigkeit von Witterungsverhältnissen. p. 396–409.

K., E. Orkan im Meerbusen von Bengalen am 27. Oktober 1906. p. 431–434.

Berichte über Land- und Forstwirtschaft in Deutsch-Ostafrika. Heidelberg. 3 Band. Heft 3. 1907.

Lommel, V. [Fünfter Jahresbericht des Kaiserlich Biologisch-Landwirtschaftlichen Instituts Amani für das Etatsjahr 1. April 1906 bis 31. März 1907.] VII. Meteorologisches. p. 48–51.

Himmel und Erde. Berlin. 19 Jahrg. Sept. 1907.

Krebs, Wilhelm. Dis sizilische Erdbebenkatastrophe vom 10. und 11. Januar 1693. p. 570–574.

Meteorologische Zeitschrift. Braunschweig. Bd. 24. Sept. 1907.

Schwalbe, G. Ueber "Niederschlagstypen" und ihren Einfluss auf die jährliche Periode des Neiderschlages. p. 385–393.

Henze, H. Beziehungen zwischen den Mittel- und Scheitelwerten der Windgeschwindigkeit in Potsdam. p. 394–405.

Meissner, Otto. Bewölkung und Sonnenschein in Potsdam (1894 bis 1900). p. 406–417.

Hann, J[ulius]. Resultate der meteorologischen Beobachtungen zu Loanda. p. 418.

Arendt, Th. Photographische Registrierung von Luftdruckschwankungen. p. 418–420.

Hann, J[ulius]. Resultate der meteorologischen Beobachtungen auf Christmas-Insel (Indischer Ozean) im Jahre 1905. p. 422.

Heidke, P. Resultate der meteorologischen Beobachtungen zu Dar-es-Salam in den Jahren 1893 bis 1902. p. 424–425.

E., F. M. Messungen der Sonnenstrahlung zu Upsala 1901, von J. Westman. p. 426.

Macdowall, Alex. Luftdruck im Frühling und Herbst. p 426–427.

C., V. Ueber einen neuen Flammenkollektor und dessen Prüfung im elektrischen Felde. p. 428–429.

Chabot, T. Eine neue Registrierungsmethode für meteorologische und geoseismiche Instrumente. p. 429–431.

—— Resultate der meteorologischen Beobachtungen in Pará im Jahre 1906. p. 431.

—— Einige Ergebnisse der meteorologischen Beobachtungen in Gibraltar. p. 432.

Physikalische Zeitschrift. Leipzig. 8 Jahrgang. 1 Okt. 1907.

Kohlrausch, K. W. F. Zur Erklärung der Unipolarität bei atmospharischen Zerstreuungsmessungen. p. 656–658.

Wetter. Berlin. 24 Jahrgang. Aug., 1907.

Fischer, Karl. Die Verbreitung von Nachrichten über die Wasserstands- und Eisverhältnisse der Flüsse durch den öffentlichen Wetterdienst in Norddeutschland. p. 169–174.

Gerstmann, Heinrich. Zur Frage einer Wetterscheide in den Alpen. p. 174–178.

Klengel, Friedrich. Die Niederschlagsverhältnisse von Deutsch-Südwestafrika. p. 178–181.

Cyran, Georg. Die Trockenheit des Jahres 1893 in Mittel-Europa. p. 182–186.

Hemel en dampkring. Den Haag. 5 Jaahrgang. Sept., 1907.

Monné, A. J. Meteorologische waarnemingen in West-Indië [1905 and 1906]. p. 80–82.

Società geografica Italiana. Bollettino. Roma. Ser. 4. v. 8. Ott. 1907.

—— Influenza delle foreste sulla velocità dei venti. [Review of article by J. Murat.] p. 1029–1030.

CORRIGENDA.

In the MONTHLY WEATHER REVIEW for September, 1907, Vol. XXXV, page 392, column 1, footnote, for "vapor" read "water"; page 393, column 1, line 31, for "H. M. Dole" read "R. M. Dole"; page 394, column 1, line —14, for "0.000075" read "0.000076"; page 394, column 1, line —13, for "15" meters read "14.4"; page 396, column 2, line 20, for "Herbert" read "Hubert".

THE WEATHER OF THE MONTH.

By Mr. P. C. DAY, Assistant Chief, Division of Meteorological Records.

PRESSURE.

The distribution of mean atmospheric pressure for September, 1907, over the United States and Canada, is graphically shown on Chart VI, and the average values and departures from the normal are shown for each station in Tables I and V.

The average pressure was below the normal for the month over all districts from western Texas northeastward to the Great Lakes and eastward to the Atlantic, except the Florida Peninsula, where the normal was exceeded by small amounts. Over the lower Lakes and St. Lawrence Valley the negative departures ranged from —.05 to —.10 inch.

From the upper Missouri Valley northward into Canada and from the Rocky Mountains to the Pacific the monthly averages of pressure were generally above the normal; the maximum positive departures, +.05 to +.10 inch, covering the districts along the northern border from North Dakota to Washington and extending into the Canadian Northwest Territories.

No marked variation occurred in the positions of the more or less permanent areas of high and low pressure, altho the changes from August conditions were generally more pronounced than the average variations from that month to September. Over nearly all portions of the United States and Canada there is normally a substantial increase in pressure from August to September, due to the cooling of the continental area. During September, 1907, this increase was well-marked over the upper Missouri Valley and thence northward over the Northwest Provinces of Canada, where the increase averaged from .10 to .15 inch. Over the Lake region and Gulf coast the decrease in pressure from that of August ranged from .05 to .07 inch.

With the normal distribution of pressure the surface winds during September along the Atlantic coast from Virginia southward and over the east Gulf States are from the northeast; in the Mississippi Valley and generally over the Plains region they are southerly, while westerly winds prevail along the Pacific coast and generally over most of the Plateau region. During the current month the general decrease of pressure over the Great Lakes and New England, and the slight increase over Florida and surrounding ocean areas were sufficient to deflect the surface winds of the Atlantic coast districts from their prevailing northeasterly course. As a result southerly winds were general over all districts east of the Rocky Mountains, except the upper Missouri Valley and the northern portion of the upper Lakes, where, under the influence of increased pressure over Manitoba and surrounding districts, northerly or westerly winds were generated.

Over the Rocky Mountain and the northern portion of the Plateau regions there was a marked decrease in wind movement, the average hourly velocity ranging from 20 to 30 per cent less than the normal.

TEMPERATURE.

The variations of the mean temperature of the month from the normal were generally small, except over the upper Missouri Valley and northern Plateau districts, where the deficiency in temperature noted in previous months of the season was continued, making the sixth consecutive month with mean temperature below the seasonal average. Over portions of the above-mentioned districts the departures for the month ranged from 4° to 8° below the average, and the accumulated deficiency for the six months, April to September inclusive, at points in North Dakota and Montana, amounted to from 5° to 6° daily.

Average temperatures from 2° to 4° below the normal occurred over central and northern California and the greater part of Nevada.

Along the Atlantic coast the mean temperatures were about 2° above, and over Texas, Arkansas, and Oklahoma they ranged from 2° to 5° above the seasonal average.

The highest temperatures for the month over the greater part of the Mississippi Valley and the Gulf and South Atlantic coast States occurred on the 1st and 2d; over Arkansas, southwestern Missouri, eastern Kansas, and portions of Texas, about the 7th; over the Plateau districts, about the 9th and 10th; and over the lower Lakes, Ohio, Pennsylvania, New York, and New England on the 15th and 16th.

Maximum temperatures of 100° or higher occurred generally over central and northern Texas, Arkansas, Oklahoma, southwestern Arizona, and southeastern California. In Arkansas

the temperatures about the 7th were unusually high, the maximum at Little Rock, 101°, being higher than recorded at that station in any previous September.

The lowest temperatures for the month over Texas and portions of Louisiana occurred generally between the 10th and 12th, over the northern portions of the Plateau and Pacific coast districts on the 13th and 14th, and over the remaining districts east of the Rocky Mountains from the 25th to the end of the month.

Temperatures of 32° or lower, with heavy to killing frosts, occurred at intervals over most of the Rocky Mountain and Plateau districts. On the 25th and 26th temperatures below freezing, with killing frosts, occurred generally over the Plains region from Nebraska and Iowa northward, the upper Mississippi Valley, northern Michigan, exposed points in the Appalachian Mountain regions and New York, and over northern New England.

PRECIPITATION.

The distribution of precipitation during September, 1907, is graphically shown on Chart IV by appropriate shading or by figures representing the actual amount of fall.

Heavy precipitation for the season was general over the Lake region, New England, and the interior of the entire Atlantic coast and east Gulf districts. It was especially heavy over the southern and eastern slopes of the Appalachian Mountains, southern New England, western Florida, and the southern portions of Georgia and Alabama, where the amounts ranged from 8 to more than 10 inches.

Heavy precipitation for the season and localities, 4 to 6 inches, occurred locally in the Lake region, the upper Mississippi Valley, western Minnesota, southeastern Nebraska, northern Kansas, and Arkansas.

Amounts generally less than 2 inches were recorded over portions of the central and lower Mississippi Valley, the greater portion of Texas, Oklahoma, southern and western Kansas, western and northern Nebraska, and North and South Dakota. Over the Rocky Mountain, Plateau, and Pacific coast districts, except western Oregon and Washington, northern Idaho, and northwestern Montana, the precipitation for the month was generally less than 1 inch. No rainfall occurred over the greater portion of central and southern California, western Arizona, and southern Nevada.

Precipitation was above normal from 2 to more than 6 inches over the interior of the Atlantic coast States from Maine to Florida and the greater portion of the east Gulf States, over most of which territory a marked deficiency existed at the end of August. Amounts from 2 to 4 inches above the normal occurred generally in the Lake region, portions of the upper Mississippi Valley, and locally in Nebraska, Kansas, and Arkansas.

Deficient rainfall was again the rule, as in August, over the greater part of Texas and the lower Mississippi Valley, where the departures averaged generally more than 2 inches below the normal. At Shreveport, in northern Louisiana, the total fall for the month was less than 3 per cent of the normal, and is the least September rainfall recorded at that station during the past thirty-five years.

Precipitation was also deficient over the greater portion of the lower Ohio and middle Mississippi valleys, the Great Plains south of Nebraska, and from the Rocky Mountains to the Pacific, except portions of western Montana, northern Idaho, and the Puget Sound region of Washington.

SNOWFALL.

Snowfall, in small amounts generally, occurred at points in the Sierra Nevada and Rocky Mountain regions, and locally over the northern portion of the States from North Dakota to Michigan, and at isolated points in New York and New England. Some unusually heavy falls for so early in the season, 15 to 24 inches, occurred in the high mountains of Montana from the 11th to the 13th.

HUMIDITY AND SUNSHINE.

Average relative humidity was in excess of the normal over all districts, except southern Florida, the lower Mississippi Valley, the slope districts from Kansas to Texas, inclusive, and along the immediate Pacific coast from central California to Washington. Over nearly the entire Rocky Mountain and Plateau districts, including central California, the relative humidity was far in excess of the average, despite the general lack of precipitation over that region. A marked excess was also general over the northern tier of States from North Dakota to New England.

Over the greater part of Texas, northern Louisiana, Arkansas, Oklahoma, and Kansas, there was a pronounced deficiency in the average relative humidity, the departures ranging from 5 to nearly 15 per cent below the normal.

An excess of cloudiness was uniform over nearly all districts, except locally in eastern Montana, a small area embracing the eastern portions of Virginia and North and South Carolina, southern Florida, the lower Mississippi Valley, and the greater part of Texas.

From North Dakota eastward over the Great Lakes and New England cloudy weather largely predominated, the excess above the normal ranging from 20 to 50 per cent.

Over the lower Mississippi Valley and the greater portion of Texas and southern Florida, there was a marked absence of clouds and much sunshine prevailed.

WEATHER IN ALASKA.

Reports from Alaska show the prevalence of the usual heavy precipitation along the southern coast with much cloudy weather over all parts of the Territory.

Freezing temperatures were of infrequent occurrence prior to the 18th, at which time a rather severe snowstorm appears to have set in over the eastern interior districts continuing several days. The accumulated depth of snow at Circle was reported as 7.5 inches on the 23d, with somewhat less amounts at surrounding points.

Average temperatures and departures from the normal.

Districts.	Number of stations.	Average temperatures for the current month.	Departures for the current month.	Accumulated departures since January 1.	Average departures since January 1.
		°	°	°	°
New England	12	61.6	+ 0.7	−20.0	− 2.2
Middle Atlantic	16	68.3	+ 1.7	−11.9	− 1.3
South Atlantic	10	75.8	+ 2.6	+ 7.6	+ 0.8
Florida Peninsula*	8	80.2	+ 1.1	+12.4	+ 1.4
East Gulf	11	76.3	+ 1.5	+16.0	+ 1.8
West Gulf	10	78.0	+ 2.6	+19.2	+ 2.1
Ohio Valley and Tennessee	13	69.0	+ 0.7	− 2.8	− 0.3
Lower Lake	10	62.8	− 0.1	−17.9	− 2.0
Upper Lake	12	58.0	− 0.9	−13.2	− 1.5
North Dakota*	9	52.6	− 5.0	−27.4	− 3.0
Upper Mississippi Valley	15	63.9	− 0.9	− 8.9	− 1.0
Missouri Valley	12	64.5	− 0.7	− 3.3	− 0.4
Northern Slope	9	55.8	− 1.4	−12.3	− 1.4
Middle Slope	6	68.8	+ 1.2	+10.3	+ 1.1
Southern Slope*	7	76.8	+ 3.0	+19.2	+ 2.1
Southern Plateau*	12	69.1	− 0.4	+ 0.1	0.0
Middle Plateau*	10	59.5	− 0.8	+ 5.0	+ 0.6
Northern Plateau*	12	57.5	− 1.1	− 8.3	− 0.9
North Pacific	7	58.0	+ 1.1	− 0.8	− 0.1
Middle Pacific	8	62.2	− 1.7	− 3.9	− 0.4
South Pacific	4	65.9	− 1.4	+ 2.7	+ 0.3

* Regular Weather Bureau and selected cooperative stations.

In Canada.—Director R. F. Stupart says:

In British Columbia, exclusive of Cariboo, the temperature was above the average by from 1° to 3°. In the Peninsula of Ontario it was also above the average by an equal amount, but over the large remaining portion of the Dominion a negative departure occurred, except in one or two isolated localities where the average was just maintained. The chief negative departure, amounting to 3°, was experienced in Saskatchewan and Alberta; elsewhere the departure was usually from 1° to 2°.

Average precipitation and departures from the normal.

Districts.	Number of stations.	Average.		Departure.	
		Current month.	Percentage of normal.	Current month.	Accumulated since Jan. 1.
		Inches.		*Inches.*	*Inches.*
New England	12	6.98	219	+3.8	−3.1
Middle Atlantic	16	6.26	186	+2.9	−2.3
South Atlantic	10	5.61	122	+1.0	−8.4
Florida Peninsula *	8	8.17	111	+0.8	−6.2
East Gulf	11	5.76	149	+1.9	−2.0
West Gulf	10	1.88	54	−1.6	−8.7
Ohio Valley and Tennessee	13	3.42	121	+0.6	−1.8
Lower Lake	10	4.30	154	+1.5	−1.5
Upper Lake	12	4.56	154	+1.6	−0.5
North Dakota *	9	1.69	131	+0.4	−0.8
Upper Mississippi Valley	15	3.02	111	+0.3	+3.1
Missouri Valley	12	1.92	71	−0.8	−2.2
Northern Slope	9	1.19	109	+0.1	+1.3
Middle Slope	6	1.89	95	−0.1	−2.1
Southern Slope *	7	1.05	37	−1.8	−2.0
Southern Plateau *	12	0.39	39	−0.6	+2.0
Middle Plateau *	10	0.60	67	−0.3	+2.2
Northern Plateau *	12	1.02	111	+0.1	+2.0
North Pacific	7	2.36	95	−0.1	−7.2
Middle Pacific	8	0.16	29	−0.4	+2.9
South Pacific	4	0.02	9	−0.2	+1.5

* Regular Weather Bureau and selected cooperative stations.

In Canada.—Director Stupart says:

In British Columbia, at Victoria, on Vancouver Island, the rainfall was 45 per cent below the usual amount, but on the mainland it was above the average, the excess varying from 3 per cent in Cariboo to 100 per cent in more southern districts. In the Western Provinces Calgary recorded an excess of precipitation of over 100 per cent, but all other localities gave a deficiency ranging from 1 per cent at Edmonton to 47 per cent at Swift Current, and 67 per cent at Winnipeg. In Ontario, at Parry Sound, the rainfall was 29 per cent less than the usual amount, and at Southampton it was the average, but all other localities recorded a positive departure, which in several districts was as much as from 60 to 80 per cent. In Quebec the rainfall was above the average, and nearly everywhere by about 25 per cent. In the Maritime Provinces Sydney recorded a deficiency of 35 per cent, whilst elsewhere there was a positive departure, the chief departures being St. John, 41 per cent; Chatham, 48 per cent; and Fredericton, 59 per cent.

Average relative humidity and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
	%			%	
New England	84	+ 3	Missouri Valley	67	+ 1
Middle Atlantic	82	+ 5	Northern Slope	65	+10
South Atlantic	82	+ 2	Middle Slope	58	0
Florida Peninsula	81	+ 1	Southern Slope	61	− 4
East Gulf	80	+ 4	Southern Plateau	47	+ 8
West Gulf	71	− 3	Middle Plateau	41	+ 7
Ohio Valley and Tennessee	76	+ 4	Northern Plateau	52	+ 2
Lower Lake	79	+ 6	North Pacific	78	+ 1
Upper Lake	82	+ 5	Middle Pacific	68	+ 3
North Dakota	75	+ 9	South Pacific	69	+ 3
Upper Mississippi Valley	77	+ 5			

Average cloudiness and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
New England	6.8	+ 1.8	Missouri Valley	4.5	+ 0.5
Middle Atlantic	5.6	+ 0.8	Northern Slope	4.4	+ 0.4
South Atlantic	4.7	− 0.1	Middle Slope	4.0	+ 0.8
Florida Peninsula	4.2	− 1.3	Southern Slope	3.4	− 0.2
East Gulf	5.3	+ 0.9	Southern Plateau	2.8	+ 0.5
West Gulf	3.4	− 0.9	Middle Plateau	3.2	+ 0.7
Ohio Valley and Tennessee	4.9	+ 0.5	Northern Plateau	4.3	+ 0.2
Lower Lake	6.7	+ 1.9	North Pacific	5.7	+ 0.8
Upper Lake	6.9	+ 1.8	Middle Pacific	3.6	+ 0.8
North Dakota	5.0	+ 0.7	South Pacific	2.4	− 0.1
Upper Mississippi Valley	4.9	+ 0.7			

Maximum wind velocities.

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
Amarillo, Tex	9	56	w.	Mount Tamalpais, Cal	30	54	nw.
Buffalo, N. Y	11	51	sw.	North Head, Wash	15	56	se.
Do	24	59	sw.	Do	26	52	se.
Duluth, Minn	20	52	nw.	Point Reyes Light, Cal	11	50	nw.
Fort Smith, Ark	2	52	w.	Do	12	60	nw.
Jacksonville, Fla	3	60	sw.	Do	27	72	nw.
Do	22	54	sw.	Do	28	74	nw.
Modena, Utah	28	56	sw.	Sand Key, Fla	15	52	se.
Mount Tamalpais, Cal	26	58	nw.	Southeast Farallon, Cal	28	52	nw.
Do	27	74	nw.	Toledo, Ohio	24	50	sw.
Do	28	60	nw.				

CLIMATOLOGICAL SUMMARY.

By Mr. JAMES BERRY, Chief of the Climatological Division.

TEMPERATURE AND PRECIPITATION BY SECTIONS, SEPTEMBER, 1907.

In the following table are given, for the various sections of the Climatological Service of the Weather Bureau, the average temperature and rainfall, the stations reporting the highest and lowest temperatures with dates of occurrence, the stations reporting greatest and least monthly precipitation, and other data, as indicated by the several headings.

The mean temperatures for each section, the highest and lowest temperatures, the average precipitation, and the greatest and least monthly amounts are found by using all trustworthy records available.

The mean departures from normal temperature and precipitation are based only on records from stations that have ten or more years of observation. Of course the number of such records is smaller than the total number of stations.

Section.	Temperature—in degrees Fahrenheit.							Precipitation—in inches and hundredths.					
	Section average.	Departure from the normal.	Monthly extremes.					Section average.	Departure from the normal.	Greatest monthly.		Least monthly.	
			Station.	Highest.	Date.	Station.	Lowest.	Date.			Station.	Amount.	Station.	Amount.
Alabama	74.8	0.0	Newbern	104	1	Hamilton	42	30	5.50	+ 3.02	Ozark	12.73	Letohatchee	0.67
			Pushmataha	104	1, 2	Valley Head	42	30						
Arizona	75.1	— 0.7	Parker	116	9	Flagstaff	24	30	0.61	— 0.52	Grand Canyon	4.78	8 stations	0.00
Arkansas	73.9	+ 0.5	Heber	106	7	Dutton	38	29	2.22	— 0.96	Warren	13.63	Texarkana	0.02
California	65.6	— 2.4	Mammoth Tank	116	9, 10	Willits	20	17	0.13	— 0.31	Monumental	3.22	Many stations	0.00
Colorado	57.5	+ 0.3	Lamar	99	13	Wagonwheel Gap	17	28	1.09	— 0.18	Meeker	3.12	Hoehne	0.06
Florida	80.0	+ 0.9	Molino	102	2	Molino	56	30	8.58	+ 1.26	Wausau	20.05	Malabar	2.94
			Rockwell	102	1									
Georgia	75.5	+ 1.0	Hawkinsville	105	1	Clayton	46	26, 27	6.24	+ 2.71	Blakely	13.16	Newnan	2.29
						Diamond	46	27						
Hawaii	75.6†	.....	Kihei, Maui	94	20	Waimea, Hawaii	50	10, 11	8.51‡	.....	Papaikou, Hawaii	37.83	Kihei, Maui	T.
			Waialua Mill, Oahu	94	4, 7									
Idaho	56.7	— 0.3	Orofino	98	10	Forney	17	20	0.78	— 0.04	Porthill	3.40	Vernon	0.08
Illinois	65.7	— 1.3	Benton	100	1	Lanark	28	25	2.63	— 0.61	Sycamore	7.39	Albion	0.32
Indiana	65.5	— 1.6	Madison	98	16	Auburn	28	16	2.91	— 0.01	Laporte	6.60	Vincennes	0.75
Iowa	62.8	— 0.7	Clarinda	98	1	Elma	25	25	2.76	— 0.60	Ridgeway	6.06	Washington	1.38
			Thurman	98	1									
Kansas	69.7	+ 0.6	Burlington	103	7	Lebanon	30	29	2.07	— 1.14	Abilene	5.38	Coldwater	0.39
			Rome	103	7									
Kentucky	69.1	— 0.9	Earlington	102	2	5 stations	35	26	3.00	+ 0.41	Eubank	6.76	Frankfort	0.95
Louisiana	78.2	+ 0.9	Minden	105	7	Robeline	45	11	3.71	+ 0.05	Lawrence	15.63	Shreveport	0.09
Maryland and Delaware	68.4	+ 0.7	Cambridge, Md.	95	21	Deer Park, Md.	30	26	6.23	+ 2.82	Annapolis, Md	10.95	Ocean City, Md.	2.46
Michigan	59.2	— 0.8	Harbor Beach	95	16	Wetmore	20	3 dates	4.65	+ 1.70	Mackinac Island	9.25	Port Austin	1.85
Minnesota	55.9	— 2.5	Glencoe	91	1	4 stations	18	27, 30	3.48	+ 0.40	Redwing	8.30	Beardsley	1.27
Mississippi	75.4	+ 0.4	Aberdeen	104	1	Ripley	40	30	3.66	+ 0.80	Leakesville	12.74	Vicksburg	0.50
						University	40	29						
Missouri	68.9	— 0.1	El Dorado Springs	101	7	Sublett	31	25	1.93	— 1.75	Huntsville	4.05	Versailles	0.70
Montana	53.5	— 1.0	Billings	97	4	Grayling	10	20	1.28	— 0.25	Red Lodge	3.94	3 stations	T.
Nebraska	63.2	— 0.8	Cambridge	101	18	Culbertson	25	28	2.50	+ 0.22	Nebraska City	8.14	Burwell	0.40
Nevada	59.9	— 0.2	Logan	108	12	Dyer	12	20	0.35	— 0.04	Battle Mountain	1.50	Geyser	0.00
New England*	60.8	+ 0.9	Danielson, Conn.	93	21	Van Buren, Me.	23	29	7.75	+ 4.24	Falls Village, Conn.	12.43	Van Buren, Me.	3.70
New Jersey	67.1	+ 0.9	Indian Mills	92	21	Charlotteburg	31	27	8.08	+ 3.85	Boonton	12.98	Cape May C. H.	3.55
			Vineland	92	21	River Vale	31	27						
New Mexico	65.1	— 0.4	Deming	104	8	Elizabethtown	21	28	1.04	— 0.82	Alto	3.51	Hope	0.00
New York	61.3	+ 1.0	Appleton	91	15, 20	Griffins Corner	28	27	5.91	+ 2.49	Bedford	12.50	Romulus	1.46
North Carolina	72.5	+ 2.0	Weldon	98	3	Banners Elk	32	25	5.05	+ 1.24	Buck Spring	9.25	Edenton	2.00
North Dakota	52.1	— 5.3	Flasher	96	1	Portal	9	29	1.39	+ 0.39	University	3.87	Buford	0.28
Ohio	65.5	0.0	Camp Dennison	93	19	Hedges	29	26	3.92	+ 1.15	Dayton No. 2	6.99	Camp Dennison	1.16
Oklahoma and Indian Territories.	75.2	+ 1.6	Chandler, Okla.	108	7	Hooker, Okla.	38	10	1.96	— 1.26	Grand, Okla.	6.15	Stillwater, Okla	0.44
Oregon	59.3	+ 0.8	4 stations	101	8–10	Granite	22	14	1.48	— 0.28	Nehalem	6.03	Huntington	0.00
Pennsylvania	64.8	+ 1.0	Derry Station	95	20	Pocono Lake	29	27	6.37	+ 3.19	Lewisburg	11.86	Davis Island Dam	2.18
Porto Rico	78.4	.....	Central Aguirre	97	10, 17	Aibonito	59	8, 23	7.58	.....	La Carmelita (b)	16.94	Vieques	2.49
South Carolina	75.9	+ 1.8	Saluda	99	3	Walhalla	45	26	5.91	+ 1.86	Blackville	10.02	Charleston	2.73
South Dakota	57.8	— 3.1	Cherry Creek	98	12	Frederick	13	30	1.75	— 0.08	Ramsey	5.17	Chamberlain	0.50
Tennessee	70.7	0.0	Kenton	101	1	Silver Lake	31	26	4.46	+ 1.46	Walling	10.09	Dickson	0.78
			Trenton	101	1									
Texas	78.9	+ 2.3	Henrietta	110	24	Plemons	38	10, 28	1.66	— 1.78	Galveston	7.56	3 stations	0.00
Utah	59.4	— 0.3	Woodruff	111	4	Lucin	17	19	0.44	— 0.41	Woodruff	2.59	2 stations	0.00
Virginia	69.2	+ 1.1	Doswell	94	21	Burkes Garden	30	26	5.65	+ 2.24	Lynchburg	10.53	Hampton	1.30
Washington	59.1	+ 0.2	Zindel	102	10	Cheney	25	13	2.08	+ 0.13	Granite Falls	6.27	Kennewick	0.18
West Virginia	66.3	+ 0.3	Doane	93	19	Bayard	30	26	4.41	+ 2.05	Pickens	7.10	Huntington	2.00
			Oceana	93	19									
Wisconsin	59.1	— 1.3	Schullsburg	96	1	Hayward	20	30	4.88	+ 1.36	Grantsburg	9.38	Menasha	2.45
Wyoming	53.3	— 0.5	Fort Laramie	95	17	Dubois	11	17	1.07	+ 0.37	Sheridan No. 1	2.91	Leo	0.12

* Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut. † 47 stations, with an average elevation of 533 feet. ‡ 133 stations.

DESCRIPTION OF TABLES AND CHARTS.

By Mr. P. C. DAY, Assistant Chief, Division of Meteorological Records.

For description of tables and charts see page 30 of REVIEW for January, 1907.

TABLE I.—*Climatological data for U. S. Weather Bureau stations, September, 1907.*

Stations.	Elevation of instruments.			Pressure, in inches.			Temperature of the air, in degrees Fahrenheit.								Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches.			Wind.				Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness during daylight, tenths.	Total snowfall.
	Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hrs.	Departure from normal.	Mean max. + mean min. ÷ 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.			Total.	Departure from normal.	Days with .01 or more.	Total movement, miles.	Prevailing direction.	Maximum velocity. Miles per hour.	Maximum velocity. Direction.	Maximum velocity. Date.				
New England.							61.6	+ 0.7							84			6.98	+ 3.8									6.8	
Eastport	76	69	85	29.92	30.00	— .03	55.7	+ 0.5	78	21	62	40	28	49	26	51	48	4.41	+ 1.4	14	6,864	s.	44	ne.	29	4	14	12	6.8	
Portland, Me.	103	81	117	29.90	30.02	— .03	58.8	— 0.8	84	21	66	40	19	52	28	55	52	83	7.81	+ 4.6	13	6,005	sw.	34	n.	29	9	8	13	6.1	
Concord	288	70	79	29.70	30.01	— .05	59.4	+ 0.3	85	16	68	36	27	51	33	....	....	....	9.26	+ 6.0	13	3,061	sw.	23	sw.	24	14	4	12	5.4	
Burlington	404	12	47	29.54	29.98	— .08	59.5	— 1.4	81	16	66	39	28	53	26	....	....	....	4.70	+ 1.4	17	6,678	se.	33	s.	24	6	12	18	8.1	
Northfield	876	16	70	29.07	30.02	— .04	56.6	+ 2.0	82	16	65	34	19	48	35	54	53	90	6.08	+ 3.3	15	4,988	s.	37	sw.	24	2	8	20	7.9	
Boston	125	115	188	29.88	30.02	— .05	64.4	+ 1.7	87	16	72	44	29	57	22	59	56	80	7.43	+ 4.2	13	7,016	sw.	36	n.	29	6	9	15	6.9	
Nantucket	12	14	90	30.01	30.02	— .06	64.3	+ 1.5	78	16	70	49	30	59	17	61	59	88	4.35	+ 1.6	10	11,233	sw.	48	nw.	29	5	9	16	6.7	
Block Island	26	11	46	30.00	30.03	— .05	64.2	+ 0.1	76	14	69	47	30	59	15	61	59	85	4.84	+ 1.8	12	11,207	sw.	44	n.	29	8	8	14	6.2	
Narragansett	....	9	....	....	....	....	62.8	0.0	84	17	71	35	27	55	27	....	....	....	7.99	....	14	....	sw.	....	....	....	11	1	18	....	
Providence	160	57	67	29.86	30.00	— .04	64.0	+ 0.8	87	21	72	41	27	56	25	59	57	83	8.66	+ 5.5	15	4,076	w.	29	w.	21	6	8	16	6.9	
Hartford	159	122	132	29.85	30.02	— .05	64.3	+ 2.6	86	16	72	41	27	57	27	59	57	82	11.56	+ 8.1	14	4,448	s.	34	w.	21	2	11	17	7.7	
New Haven	106	116	155	29.91	30.02	— .05	65.4	+ 1.5	86	21	73	42	27	58	22	61	59	85	7.67	+ 3.9	14	5,721	s.	41	s.	23	9	7	14	6.4	
Mid. Atlantic States.							68.3	+ 1.7							82			6.26	+ 2.9									5.6	
Albany	97	102	115	29.91	30.01	— .06	64.0	+ 1.7	86	16	72	42	26	56	27	59	56	82	5.81	+ 2.6	14	4,346	s.	30	s.	24	3	11	16	7.4	
Binghamton	875	78	90	29.06	29.99	— .08	62.2	+ 2.2	83	15	71	38	27	54	31	....	....	....	5.44	+ 2.7	16	3,344	w.	28	w.	2	2	3	25	8.4	
New York	314	108	350	29.68	30.01	— .07	67.8	+ 1.3	85	21	74	46	26	61	19	62	59	79	8.00	+ 4.4	13	7,632	s.	43	w.	11	7	6	17	6.6	
Harrisburg	374	94	104	29.63	30.02	— .06	66.5	+ 1.6	84	21	74	42	27	59	25	61	59	83	8.27	+ 5.4	16	3,928	w.	34	w.	2	6	11	13	6.4	
Philadelphia	117	116	184	29.90	30.03	— .05	69.6	+ 2.2	89	17	77	48	26	62	21	63	60	79	5.99	+ 2.6	16	6,200	sw.	32	nw.	25	7	7	16	6.4	
Scranton	805	111	119	29.16	30.01	— .06	64.4	+ 2.2	83	16	72	39	27	56	29	60	57	82	7.11	+ 4.2	16	4,081	sw.	38	sw.	24	4	6	20	7.3	
Atlantic City	52	37	48	29.98	30.03	— .04	67.7	+ 0.1	82	21	73	44	26	62	19	64	62	84	5.09	+ 2.0	14	5,435	sw.	37	sw.	23	6	7	17	6.6	
Cape May	17	48	52	30.03	30.05	— .02	69.6	— 0.4	82	17	73	50	26	64	18	65	....	....	3.82	+ 0.8	11	5,508	s.	36	s.	23	10	13	7	5.1	
Baltimore	123	69	117	29.89	30.02	— .06	69.9	+ 1.3	90	21	78	46	27	62	23	64	61	80	8.52	+ 4.7	15	4,300	sw.	28	nw.	11	9	8	13	6.0	
Washington	112	59	76	29.90	30.02	— .06	69.4	+ 1.3	91	21	78	43	27	60	26	64	61	84	7.15	+ 3.6	13	3,774	nw.	34	nw.	25	11	9	10	5.2	
Cape Henry	18	11	58	30.02	30.04	— .02	74.4	+ 2.6	92	21	81	55	26	67	24	....	....	....	1.32	— 2.8	11	7,755	sw.	39	s.	23	16	11	3	3.4	
Lynchburg	681	83	88	29.31	30.04	— .04	70.8	+ 2.4	91	2	82	44	26	60	31	64	63	84	10.53	+ 6.9	11	2,037	nw.	24	nw.	23	16	12	2	4.1	
Mount Weather	1,725	10	57	28.24	30.02	— .05	64.6	+ 2.2	83	21	71	38	26	58	21	59	56	80	7.81	+ 5.0	14	8,578	nw.	40	nw.	24	10	11	9	4.7	
Norfolk	91	102	111	29.95	30.05	— .01	75.0	+ 3.3	90	18	82	52	26	68	22	68	66	80	3.01	— 1.0	9	5,748	s.	36	se.	23	14	10	6	4.5	
Richmond	144	145	153	29.89	30.04	— .03	72.8	+ 2.0	92	21	82	47	26	63	29	....	....	....	6.51	+ 3.1	11	4,925	se.	36	s.	23	15	8	7	4.1	
Wytheville	2,293	40	47	27.71	30.04	— .03	65.5	+ 1.9	85	2	76	38	26	54	32	59	57	85	5.86	+ 2.6	14	2,665	w.	18	sw.	24	16	9	5	4.0	
S. Atlantic States.							75.8	+ 2.6							82			5.61	+ 1.0									4.7	
Asheville	2,255	53	78	27.74	30.05	— .02	66.4	+ 1.4	88	2	77	43	26	56	32	60	57	80	4.57	+ 1.5	13	3,896	se.	24	n.	29	16	8	6	4.1	
Charlotte	773	68	76	29.22	30.05	— .02	73.6	+ 2.9	90	3	83	53	26	65	24	66	62	75	3.76	+ 0.5	10	4,152	s.	29	sw.	23	9	13	8	4.8	
Hatteras	11	12	47	30.04	30.05	— .01	76.7	+ 2.0	86	19	82	62	26	72	17	72	71	84	6.06	+ 0.7	11	8,256	sw.	37	sw.	23	21	7	2	3.1	
Raleigh	376	71	79	29.65	30.04	— .03	73.8	+ 3.2	91	9	84	49	27	64	27	67	64	80	6.13	+ 2.8	8	3,801	s.	24	s.	23	15	8	7	4.4	
Wilmington	78	81	91	29.96	30.04	— .01	76.7	+ 3.6	89	25	84	60	26	69	20	71	69	84	6.01	+ 0.7	8	5,192	sw.	32	sw.	23	15	10	5	4.2	
Charleston	48	14	92	29.98	30.03	— .01	79.4	+ 3.2	90	8	85	64	27	74	17	73	71	83	2.73	— 2.7	11	7,571	s.	36	s.	29	8	16	6	5.0	
Columbia, S. C.	351	41	57	29.66	30.04	— .01	76.4	+ 2.7	94	3	86	59	30	67	26	68	66	79	5.72	+ 2.3	11	4,397	sw.	26	sw.	10	10	11	9	5.6	
Augusta	180	89	97	29.83	30.02	— .03	77.1	+ 2.7	95	3	86	63	26	68	26	69	67	82	3.88	+ 0.2	13	3,908	s.	34	w.	3	12	14	4	4.1	
Savannah	65	81	89	29.96	30.03	.00	78.5	+ 3.1	92	7	86	63	27	71	21	72	71	87	6.82	+ 1.3	13	4,887	sw.	24	w.	29	4	15	11	6.0	
Jacksonville	43	101	129	29.97	30.02	+ .02	79.0	+ 1.7	94	1	86	68	4	72	24	74	73	90	10.44	+ 2.4	19	6,039	sw.	60	sw.	3	5	17	8	5.5	
Florida Peninsula.							81.3	+ 0.8							81			7.03	— 0.6									4.2	
Jupiter	28	10	48	29.97	30.00	+ .04	81.0	+ 0.4	91	12	87	68	17	75	19	76	75	83	7.47	— 2.1	15	7,096	se.	36	e.	17	8	19	3	4.8	
Key West	24	10	53	29.96	29.97	+ .03	82.4	— 0.1	90	6	88	72	12	77	16	76	73	76	8.17	+ 1.4	16	5,986	e.	30	se.	15	11	18	1	4.9	
Sand Key	25	41	71	29.94	29.97	+ .03	81.6	.....	92	1	85	70	11	78	15	....	....	....	3.94	— 2.8	8	9,328	e.	52	se.	15	7	20	3	5.1	
Tampa	35	79	96	29.97	30.00	+ .03	80.4	+ 2.1	93	1	88	66	3	72	23	74	72	84	8.54	+ 1.1	18	5,261	ne.	39	e.	12	16	14	0	3.0	
East Gulf States.							76.3	+ 1.5							80			5.76	+ 1.9									5.3	
Atlanta	1,174	190	216	28.82	30.03	— .02	73.2	+ 1.1	93	2	81	52	30	65	27	65	62	75	3.58	0.0	10	5,973	e.	48	nw.	3	14	7	9	4.7	
Macon	370	55	66	29.63	30.02	— .01	76.6	+ 3.7	96	2	86	55	30	67	29	....	....	....	6.15	+ 2.8	13	2,984	e.	36	w.	3	9	11	10	5.2	
Thomasville	273	8	57	29.72	30.01	.00	78.2	+ 1.4	98	1	87	62	30	70	25	72	71	90	8.65	+ 4.4	19	3,338	ne.	32	w.	3	12	10	8	5.1	
Pensacola	56	79	96	29.5.	29.98	— .01	78.4	+ 0.5	98	1	85	63	30	72	24	....	....	....	14.51	+ 9.3	14	7,127	ne.	46	ne.	28	9	6	15	6.1	
Anniston	741	9	58	29.26	30.04	+ .01	73.4	+ 2.1	99	2	84	47	30	63	35	....	....	....	5.45	+ 1.9	8	3,040	se.	28	nw.	8	9	9	12	5.4	
Birmingham	700	136	144	29.26	30.02	— .01	74.1	+ 0.1	98	2	83	50	30	65	31	67	64	78	7.03	+ 3.5	9	4,971	e.	44	sw.	3	8	10	12	5.9	
Mobile	57	98	106	29.92	29.98	— .02	78.6	+ 2.1	97	1	86	62	30	71	24	72	71	85	6.98	+ 2.0	12	4,643	n.	30	sw.	3	8	14	8	5.7	
Montgomery	223	100	112	29.76	30.01	— .01	76.7	+ 0.9	98	2	86	56	30	68	26	68	65	76	3.29	+ 0.4	7	4,469	e.	43	sw.	3	8	13	9	5.5	
Meridian	375	84	93	29.61	29.99	— .03	74.5	+ 1.8	96	2	85	50	30	64	29	67	64	78	1.92	— 1.6	6	3,243	e.	28	nw.	3	14	8	8	4.6	
Vicksburg	247	62	74	29.72	29.99	— .03	76.4	+ 1.6	92	8	86	57	29	67	25	68	65	76	0.50	— 2.8	6	4,003	e.	24	ne.	8	13	14	3	4.2	
New Orleans	51	88	121	29.91	29.96	— .02	79.4	+ 1.4	94	2	86	67	28	75	20	73	71	83	5.31	+ 0.5	12	5,457	ne.	31	nw.	3	5	11	14	6.2	
West Gulf States.							78.0	+ 2.0							71			1.38	— 1.6									3.4	
Shreveport	249	77	84	29.72	29.98	— .02	78.6	+ 2.9	100	7	90	55	11	67	29	67	62	66	0.09	— 3.1	2	4,008	se.	25	nw.	9	23	5	2	2.2	
Bentonville	1,303	11	44	28.66	30.03	+ .01	71.0	+ 2.1	96	7	84	44	29	58	37	....	....	....	0.58	— 2.9	6	3,827	s.	20	sw.	27	20	8	2	3.4	
Fort Smith	457	79	94	29.51	29.98	— .03	74.9	+ 2.2	101	6	87	50	29	63	33	65	60	69	2.66	— 0.5	6	5,268	e.	52	w.	2	18	10	2	2.5	
Little Rock	357	93	100	29.62	29.99	— .04	75.0	+ 1.9	101	7	86	53	30	64	30	65	60	67	1.08	— 2.2	3	4,272	ne.	28	nw.	2	8	20	2	4.4	
Corpus Christi	20	48	53	29.93	29.95	.00	80.8	+ 1.8	91	2	86	67	11	75	18	74	72	80	0.75	— 3.2	5	6,260	se.	31	ne.	25	16	11	3	3.4	
Fort Worth	670	106	114	29.27	29.97	— .02	79.6	+ 2.9	101	6	91	56	10	68	31	....	....	....	1.92	— 1.0	4	6,313	se.	30	nw.	20	19	11	0	2.9	
Galveston	54	106	112	29.92	29.98	.00	80.4	+ 1.0	93	2	86	68	11	75	21	74	71	78	7.56	+ 2.2	10	6,892	se.	34	se.	15	14	14	2	4.0	
Palestine	510	73	79	29.43	29.95	— .04	78.2	+ 3.5	98	2	89	53	11	67	32	68	63	69	2.91	— 0.3	6	3,973	e.	26	n.	9	14	10	6	4.4	
San Antonio	701	80	91	29.22	29.93	— .03	81.4	+ 4.3	100	9	93	58	11	70	32	69	64	66	1.11	— 1.8	5	3,624	se.	24	ne.	9	16	14	0	3.3	
Taylor	853	55	63	29.36	29.97	.00	80.0	+ 3.1	100	2	92	53	11	68	35	....	....	....	0.09	— 3.0	3	4,590	se.	23	n.	9	17	10	3	3.0	
Ohio Val. and Tenn.							69.0	+ 0.7							76			3.42	+ 0.6									4.9	
Chattanooga	762	106	112	29.25	30.05	— .01	72.2	+ 1.0	95	2	82	54	30	63	30	64	61	74	5.90	+ 2.6	8	3,452	ne.	48	sw.	8	12	12	6	4.7	
Knoxville	1,004	93	100	29.00	30.04	— .02	70.5	+ 1.1	91	2	80	48	26	61	27	63	61	78	6.89	+ 4.1	11	2,979	ne.	28	w.	2	11	10	9	5.0	
Memphis	399	78	97	29.61	30.03	.00	74.2	+ 1.4	93	1	83	50	30	66	29	65	61	70	1.55	— 1.5	6	4,894	ne.	34	n.	2	16	10	4	3.5	
Nashville	546	79	91	29.47	30.05	— .01	71.4	— 0.1	93	1	82	47	26	61	31	63	59	72	1.95	— 1.7	9	3,679	nw.	23	e.	21	15	4	11	4.7	
Lexington	989	75	102	28.99	30.04	— .03	68.0	+ 0.1	89	19	78	42	26	58	28	....	....	....	2.72	+ 0.3	5	5,495	sw.	30	w.	28	15	8	7	4.2	
Louisville	525	111	132	29.46	30.04	— .02	70.9	+ 1.0	92	1	81	44	26	61	30	62	58	72	1.46	— 1.2	7	4,450	s.	35	sw.	2	16	6	8	4.2	
Evansville	431	72	82	29.54	30.01	— .05	69.6	— 0.1	91	1	79	45	26	60	28	....	....	....	2.76	+ 0.1	7	3,835	s.	24	se.	1	16	10	4	4.1	
Indianapolis	822	154	164	29.14	30.03	— .03	65.8	— 0.9	87	19	75	40	26	57	28	59	55	75	2.31	— 0.7	10	5,751	sw.	33	sw.	11	5	12	13	6.5	
Cincinnati	628	152	160	29.36	30.03	— .04	69.2	+ 0.2	90	19	79	43	26	60	30	61	57	70	1.20	— 1.1	7	4,013	se.	27	w.	24	13	11	6	4.8	
Columbus	824	173	224	29.16	30.02	— .05	66.7	+ 0.8	87	16	76	39	26	58	26	60	56	76	2.27	— 0.2	9	6,725	s.	36	nw.	24	9	13	8	5.2	
Pittsburg	842	336	352	29.12	30.02	— .06	66.6	+ 0.5	84	20	74	42	26	59	25	60	57	75	3.25	+ 0.8	12	5,878	sw.	33	w.	5	6	13	11	6.3	
Parkersburg	638	77	84	29.38	30.04	— .04	67.9	+ 1.8	88	20	77	40	26	59	29	62	59	82	5.16	+ 2.4	14	3,094	se.	36	nw.	2	12	10	8	4.8	
Elkins	1,940	41	50	28.04	30.07	— .01	64.2	+ 2.3	86	10	73	35	26	54	32	58	57	92	7.10	+ 4.2	16	1,903	w.	20	w.	11	10	11	9	5.6	
Lower Lake Region.							62.8	— 0.1							73			4.30	+ 1.5									5.7	
Buffalo	767	178	208	29.15	29.97	— .09	62.2	— 0.7	77	20	68	44	26	57	22	58	55	80	3.73	+ 0.6	16	10,556	sw.	59	sw.	24	2	17	11	6.5	
Canton	448	10	71	29.48	29.95	.....	59.2	— 0.1	82	15	68	36	26	51	30	....	....	....	4.74	+ 1.9	16	7,662	sw.	44	sw.	11	4	11	15	7.2	
Oswego	335	76	91	29.69	29.97	— .09	61.8	— 0.9	85	20	68	45	26	56	28	58	55	82	2.46	— 0.4	17	6,605	s.	32	w.	24	3	8	19	7.3	
Rochester	523	81	102	29.42	29.99	— .07	63.2	+ 1.8	87	20	71	44	26	56	27	57	54	78	3.14	+ 0.8	17	5,744	sw.	38	sw.	24	3	10	17	7.2	
Syracuse	597	97	113	29.34	29.98	— .09	62.0	+ 0.4	84	16	69	42	26	55	23	....	....	....	3.25	+ 0.4	21	6,700	s.	37	sw.	24	2	7	21	8.1	
Erie	713	92	102	29.22	29.98	— .08	63.5	— 0.4	86	20	70	47	26	57	23	58	55	76	6.72	+ 3.2	19	6,914	w.	33	w.	16	8	9	13	5.9	
Cleveland	762	190	201	29.18	30.00	— .06	64.2	— 0.1	87	20	71	45	26	57	28	59	55	74	3.45	+ 0.2	16	9,292	se.	40	nw.	25	3	19	8	6.3	T.
Sandusky	629	62	70	29.32	29.99	— .07	65.0	— 0.3	87	20	72	39	26	57	29	....	....	....	6.63	+ 4.0	13	5,235	sw.	30	w.	24	7	12	11	5.8	
Toledo	628	207	246	29.32	30.00	— .06	64.6	+ 0.5	86	15	72	40	26	57	25	59	56	78	4.77	+ 2.4	11	8,731	sw.	50	sw.	24	11	8	11	5.4	
Detroit	730	218	258	29.21	30.00	— .06	62.8	— 0.3	83	15	70	38	26	56	22	58	56	83	4.10	+ 1.6	15	8,833	w.	48	w.	24	5	16	9	6.9	
Upper Lake Region.							58.0	— 0.9							82			4.56	+ 1.6									6.9	
Alpena	609	13	92	29.30	29.96	— .07	58.0	+ 0.7	88	1	66	34	26	50	32	54	52	86	2.94	— 0.5	19	7,567	w.	31	w.	20	3	10	17	7.2	
Escanaba	612	40	82	29.30	29.96	— .05	55.6	— 1.3	90	1	63	32	22	48	27	51	49	82	3.34	— 0.2	13	6,968	ne.	36	w.	20	7	11	12	5.7	
Grand Haven	632	54	92	29.29	29.96	— .08	60.1	— 1.0	80	1	66	36	26	54	20	56	54	81	4.49	+ 1.3	14	8,435	s.	42	w.	24	7	10	13	6.7	

TABLE I.—*Climatological data for U. S. Weather Bureau stations, September, 1907*—Continued.

Stations.	Elevation of instruments.			Pressure, in inches.			Temperature of the air, in degrees Fahrenheit.								Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches.			Wind.					Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness during daylight, tenths.	Total snowfall.
	Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hrs.	Departure from normal.	Mean max. + mean min. ÷ 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.				Total.	Departure from normal.	Days with .01, or more.	Total movement, miles.	Prevailing direction.	Maximum velocity. Miles per hour.	Maximum velocity. Direction.	Maximum velocity. Date.				
Up. Lake Reg—Cont.																													
Grand Rapids	707	121	162	29.22	29.99	— .06	60.9	— 0.9	89	1	68	36	26	54	25	56	54	82	5.49	+ 2.4	14	6,930	sw.	40	w.	24	4	6	20	7.4	
Houghton	668	66	74	29.20	29.92	— .08	54.4	— 1.7	75	19	61	34	30	47	27	....	....	...	5.39	+ 1.8	15	5,463	w.	33	w.	21	4	10	16	6.8	T.
Marquette	734	77	116	29.16	29.96	— .04	54.6	— 2.2	81	1	61	34	30	48	28	50	48	82	5.79	+ 2.3	18	6,577	nw.	44	sw.	20	1	11	18	7.6	
Port Huron	638	70	120	29.29	29.98	— .08	61.9	+ 1.0	84	15	70	35	26	54	25	57	54	83	4.53	+ 1.8	13	6,991	sw.	33	w.	24	6	7	17	6.9	
Sault Ste. Marie	614	40	61	29.26	29.96	— .06	54.5	+ 0.2	78	15	62	31	27	48	24	51	49	86	2.36	— 1.1	17	6,259	e.	48	w.	24	2	8	20	8.1	T.
Chicago	823	140	310	29.12	29.99	— .05	64.6	0.0	92	1	71	39	25	58	21	58	55	75	4.49	+ 1.5	11	9,416	sw.	40	nw.	24	7	11	12	6.1	
Milwaukee	681	122	158	29.26	29.99	— .04	61.0	— 0.5	92	1	68	38	25	54	25	55	52	76	5.39	+ 2.5	13	6,676	w.	30	w.	1	11	8	11	5.7	
Green Bay	617	49	86	29.28	29.94	— .08	59.1	0.0	87	1	67	33	30	51	28	54	51	80	3.80	+ 0.7	13	7,247	sw.	38	w.	21	2	7	21	7.8	
Duluth	1,133	11	47	28.74	29.96	— .02	51.5	— 5.2	74	11	58	29	30	45	27	48	46	88	6.71	+ 3.2	19	8,606	ne.	52	nw.	20	7	6	17	6.8	T.
North Dakota.							52.1	— 5.1										75	1.70	0.0									5.0	
Moorhead	940	8	57	28.98	30.00	+ .04	53.0	— 3.6	76	11	64	24	30	42	36	48	46	86	4.02	+ 1.7	10	5,122	nw.	30	nw.	23	8	10	12	5.7	
Bismarck	1,674	8	57	28.25	30.05	+ .11	52.8	— 4.3	87	5	65	22	29	40	39	46	41	71	1.19	0.0	7	6,959	nw.	41	nw.	23	15	8	7	4.2	
Devils Lake	1,482	11	44	28.41	29.99	+ .05	51.1	— 4.5	79	5	64	21	27	39	39	45	41	77	1.13	— 1.2	9	7,713	nw.	36	nw.	23	13	9	8	4.6	
Williston	1,875	14	44	28.02	30.01	+ .08	51.4	— 8.1	81	6	65	13	29	37	47	44	38	66	0.45	— 0.5	7	5,593	nw.	48	nw.	23	12	7	11	5.5	
Upper Miss. Valley.							63.9	— 0.9										77	3.62	+ 0.3									4.9	
Minneapolis	.....	102	208	.....	.....	.....	58.4	.....	84	13	67	33	30	50	26	.....	.....	...	4.26	+ 0.6	10	8,395	nw.	48	nw.	24	8	11	11	5.6	
St. Paul	837	171	179	29.06	29.96	— .03	58.4	— 1.9	83	13	67	33	30	50	27	52	48	74	2.48	— 0.9	11	7,307	nw.	40	nw.	24	6	15	9	6.1	
La Crosse	714	71	87	29.20	29.96	— .05	60.0	— 1.7	85	15	69	33	25	51	26	.....	.....	....	3.85	— 0.3	9	5,216	s.	32	e.	19	3	12	15	6.7	
Madison	974	70	78	28.94	29.97	— .06	60.2	— 0.9	87	1	68	36	25	52	24	55	51	78	4.69	+ 1.5	12	6,718	w.	30	ne.	28	11	9	10	5.5	
Charles City	1,015	8	58	28.92	29.99	— .01	59.3	— 2.4	83	15	70	29	25	49	31	54	52	85	3.65	+ 0.8	9	4,693	nw.	26	nw.	24	4	16	10	6.3	
Davenport	606	71	79	29.34	29.99	— .04	64.0	— 0.7	91	1	73	36	25	55	27	58	55	79	3.55	+ 0.4	11	4,722	nw.	24	nw.	24	12	12	6	4.8	
Des Moines	861	84	101	29.10	30.00	— .02	63.8	— 1.2	90	18	74	35	25	54	37	56	53	73	2.40	— 0.7	9	5,607	nw.	29	sw.	19	11	12	7	5.0	
Dubuque	698	100	117	29.26	30.00	— .03	61.7	— 1.9	88	1	71	36	25	53	27	56	52	77	6.01	+ 2.4	14	4,694	nw.	26	nw.	24	8	11	11	5.6	
Keokuk	614	64	77	29.34	30.01	— .02	66.4	0.0	94	1	76	37	25	57	27	59	55	77	1.94	— 2.0	9	4,200	nw.	24	nw.	24	17	7	6	3.8	
Cairo	356	87	93	29.65	30.03	— .02	70.6	+ 0.4	93	1	80	48	26	62	27	64	61	79	1.14	— 1.3	5	4,895	ne.	42	nw.	2	18	8	4	3.2	
La Salle	536	56	64	29.44	30.01	— .03	63.6	— 0.3	92	1	73	36	25	54	27	....	....	....	4.99	+ 1.8	13	4,553	nw.	25	w.	24	10	11	9	5.6	
Peoria	609	11	45	29.36	30.02	— .02	64.4	+ 0.1	91	1	75	33	25	54	30	58	55	80	2.94	— 0.2	11	4,401	s.	35	n.	1	15	10	5	3.6	
Springfield, Ill	644	10	92	29.33	30.01	— .04	67.3	+ 0.9	93	1	77	40	25	57	28	59	56	75	0.92	— 2.4	7	5,271	s.	26	nw.	24	15	8	7	3.9	
Hannibal	534	75	109	29.44	30.01	— .02	66.9	— 1.0	92	1	77	36	25	57	32	....	....	....	0.92	— 2.6	7	5,582	sw.	28	s.	27	13	8	9	4.6	
St. Louis	567	208	217	29.41	30.00	— .04	68.6	— 1.4	91	1	77	46	25	60	28	61	56	69	1.57	— 1.3	7	6,800	s.	38	n.	7	18	6	6	3.9	
Missouri Valley.							64.5	— 0.7										67	1.92	— 0.8									4.5	
Columbia, Mo	784	11	84	29.17	29.99	— .04	67.4	— 0.4	93	17	79	37	29	56	31	....	....	....	1.01	— 1.8	7	4,750	s.	32	nw.	8	19	4	7	3.3	
Kansas City	963	116	181	29.01	30.03	+ .01	68.7	+ 1.2	93	1	78	47	25	59	27	59	58	67	1.64	— 2.1	8	8,651	s.	36	w.	27	14	12	4	4.1	
Springfield, Mo	1,324	98	104	28.63	30.02	— .01	69.0	+ 1.1	93	7	79	44	29	59	29	60	55	71	1.92	— 1.8	7	6,669	se.	27	nw.	8	22	5	3	2.7	
Iola	984	40	47	28.98	30.01	.00	70.2	+ 1.6	99	7	82	44	25	58	34	....	....	....	1.47	— 1.9	12	5,436	s.	25	w.	27	10	12	8	4.8	
Topeka	.....	85	89	.....	.....	.....	68.6	+ 0.3	95	1	80	43	28	57	35	...	....	....	1.87	— 1.7	10	6,124	s.	34	s.	19	11	15	4	4.0	
Lincoln	1,189	11	84	28.72	29.96	— .03	66.4	+ 1.2	94	18	78	38	25	55	43	56	50	65	4.09	+ 1.4	10	7,092	s.	32	s.	13	15	8	7	4.5	
Omaha	1,105	115	121	28.81	29.98	— .02	66.2	+ 0.4	92	17	76	41	28	57	36	57	51	66	2.35	— 0.7	6	5,745	s.	38	n.	27	9	12	9	5.4	
Valentine	2,598	47	54	27.30	30.00	+ .04	58.4	— 3.9	90	17	71	31	29	46	43	50	44	67	1.23	— 0.6	9	6,428	nw.	37	nw.	22	11	16	3	4.1	
Sioux City	1,135	96	164	28.78	29.98	.00	62.6	— 2.1	90	18	74	33	25	51	38	....	....	....	2.03	— 0.4	10	8,309	nw.	42	nw.	23	11	12	7	4.9	
Pierre	1,572	70	75	28.35	30.00	+ .05	59.4	— 3.4	88	5	72	35	29	47	42	50	42	61	1.96	+ 0.8	12	6,182	nw.	39	nw.	23	9	11	10	5.0	
Huron	1,306	56	67	28.61	30.02	+ .06	57.0	— 2.6	87	18	71	26	28	43	42	49	44	71	0.99	— 0.7	10	6,799	nw.	36	nw.	23	8	7	15	5.9	
Yankton	1,233	49	57	28.67	29.98	.00	61.2	— 2.1	92	18	74	33	28	48	40	....	....	....	2.54	+ 0.1	10	4,944	nw.	28	nw.	23	10	7	13	5.7	
Northern Slope.							55.8	— 1.4										65	1.19	+ 0.1									4.4	
Havre	2,505	11	44	27.38	30.00	+ .06	54.4	— 3.2	87	2	68	24	29	41	44	47	42	70	0.83	— 0.2	5	5,513	e.	30	nw.	2	15	13	2	4.0	0.1
Miles City	2,371	26	48	27.50	30.04	+ .09	59.5	— 1.7	90	2	73	26	29	46	40	50	45	66	0.16	— 0.8	1	4,135	ne.	39	nw.	8	20	5	5	3.1	
Helena	4,110	8	56	25.85	29.98	+ .01	54.4	— 1.8	81	2	66	32	13	43	34	45	37	59	0.81	— 0.2	9	4,715	sw.	36	w.	21	12	11	7	4.7	4.8
Kalispell	2,962	8	34	26.97	30.02	+ .06	52.6	— 1.3	78	1	64	34	18	41	37	46	42	76	2.12	+ 0.8	12	3,083	sw.	22	n.	10	11	10	9	5.1	
Rapid City	3,234	46	50	.....	.....	.....	.....	.....	...	...	...	...	...	...	...	.....	.....	...	.....	.....	...	.....	.....	...	...	...	...	...	...	...	
Cheyenne	6,088	56	64	24.07	29.96	.00	56.8	— 0.4	82	12	71	30	30	43	37	45	36	56	0.92	0.0	6	6,516	nw.	38	w.	19	9	14	7	4.7	2.8
Lander	5,372	26	36	24.68	29.98	+ .02	56.2	+ 1.0	83	10	72	31	14	40	47	46	38	60	0.58	— 0.4	5	2,504	w.	28	nw.	6	11	16	3	4.3	
Sheridan	3,790	5	...	26.13	30.00	.....	56.3	.....	89	2	70	32	14	42	44	...	....	...	2.91	.....	8	.....	nw.	...	...	...	12	9	9	5.0	
Yellowstone Park	6,200	11	48	23.93	29.99	+ .02	50.6	— 2.8	77	4	64	26	20	37	39	41	32	59	1.19	+ 0.2	9	4,891	sw.	37	sw.	12	9	15	6	4.8	1.0
North Platte	2,821	11	51	27.10	30.00	+ .03	61.8	— 1.4	90	12	76	32	10	47	45	53	48	73	2.91	+ 1.4	7	4,283	se.	25	nw.	19	16	7	7	3.5	
Middle Slope.							66.3	+ 1.2										58	1.89	— 0.1									4.0	
Denver	5,291	129	136	24.78	29.97	+ .01	63.0	+ 0.3	87	11	77	32	30	48	41	49	39	51	0.74	— 0.2	5	5,143	s.	36	n.	7	17	8	5	3.9	1.5
Pueblo	4,685	80	86	25.32	29.94	— .02	65.7	+ 1.3	92	12	82	38	10	50	48	50	38	46	0.32	— 0.3	6	4,411	nw.	32	n.	26	19	10	1	2.7	
Concordia	1,398	42	50	28.32	29.98	— .01	68.6	+ 0.5	96	1	81	40	28	56	41	57	52	64	5.36	+ 2.8	9	5,547	s.	29	w.	19	11	13	6	4.6	
Dodge	2,509	44	54	27.39	29.96	— .02	69.0	+ 0.8	93	19	82	36	28	56	47	57	51	62	1.71	— 0.1	7	7,448	se.	33	se.	13	11	16	3	4.3	
Wichita	1,358	78	86	28.58	29.99	— .01	71.8	+ 2.0	96	6	85	42	28	59	39	60	53	61	1.88	— 1.2	9	6,197	s.	30	sw.	26	9	16	5	4.7	
Oklahoma	1,214	10	47	28.70	29.96	— .03	74.4	+ 2.3	102	6	87	45	28	62	33	63	58	66	1.34	— 1.4	5	10,746	s.	42	s.	30	12	16	2	4.0	
Southern Slope.							75.3	+ 3.0										61	0.60	— 2.0									3.4	
Abilene	1,738	45	54	28.17	29.94	— .02	79.5	+ 5.3	98	5	92	53	10	68	33	64	55	52	0.46	— 2.7	3	5,155	s.	29	se.	18	14	14	2	3.6	
Amarillo	3,676	10	49	26.27	29.93	— .03	70.8	+ 3.1	91	7	84	42	28	57	38	59	54	65	0.91	— 1.4	3	8,503	s.	56	w.	9	17	13	0	3.8	
Del Rio	944	8	57	28.95	29.92	— .02	82.5	+ 3.6	103	3	95	61	12	70	33	....	....	....	0.09	— 2.8	3	5,357	se.	26	ne.	9	21	9	0	2.2	
Roswell	3,578	9	57	26.33	29.90	— .02	70.4	+ 0.1	93	7	86	43	24	55	45	59	54	67	0.96	— 1.3	2	3,570	s.	23	sw.	30	11	16	3	4.2	
Southern Plateau.							70.4	— 0.2										47	0.47	— 0.6									2.8	
El Paso	3,762	10	110	26.19	29.87	— .01	74.8	+ 2.1	92	8	87	54	28	63	37	60	52	56	0.96	— 0.5	5	5,046	e.	33	sw.	29	14	15	1	3.5	
Santa Fe	7,013	33	39	23.34	29.93	.00	60.2	— 0.4	78	12	73	34	30	47	36	48	41	58	0.69	— 0.8	6	5,286	ne.	36	ne.	9	19	11	0	2.7	
Flagstaff	6,907	8	57	23.43	29.91	+ .02	55.9	+ 0.4	80	10	72	24	30	39	50	45	37	59	1.17	— 0.9	5	5,063	n.	39	sw.	28	17	8	5	3.3	
Phoenix	1,108	50	56	28.69	29.81	.00	82.8	+ 1.4	106	8	97	51	30	68	39	62	47	36	0.02	— 1.0	2	2,901	e.	19	sw.	13	12	17	1	3.5	
Yuma	141	16	46	29.64	29.78	.00	82.2	— 1.7	111	8	100	50	30	65	47	64	51	44	T.	— 0.2	0	3,763	w.	20	se.	12	28	1	1	1.0	
Independence	3,910	11	42	25.96	29.90	+ .04	66.3	— 2.8	92	10	81	44	20	51	39	48	28	27	0.00	— 0.2	0	4,739	nw.	30	n.	29	21	6	3	2.7	
Middle Plateau.							60.6	— 0.5										41	0.31	— 0.5									3.2	
Reno	4,532	56	63	25.48	29.94	— .01	58.7	— 1.0	90	9	75	33	19	42	44	45	33	47	0.05	— 0.2	2	3,717	w.	28	w.	25	20	10	0	2.1	
Tonopah	6,089	12	20	24.10	29.94	.....	61.6	+ 3.5	85	10	72	33	29	51	29	43	21	24	0.04	— 0.5	1	6,647	se.	40	nw.	28	19	10	1	2.9	
Winnemucca	4,344	18	56	25.62	29.99	+ .06	58.2	— 2.3	91	10	76	27	19	40	50	45	34	48	0.47	+ 0.1	4	3,785	ne.	26	sw.	4	20	5	5	3.1	
Modena	5,479	10	43	24.64	29.92	.00	57.8	— 2.4	88	10	77	26	20	39	49	42	24	34	0.09	— 0.4	1	7,735	sw.	56	sw.	28	17	5	8	3.9	
Salt Lake City	4,366	105	110	25.62	29.93	— .02	63.4	— 1.7	89	11	75	41	20	52	34	49	36	40	0.10	— 0.8	4	4,345	se.	29	s.	28	19	7	4	3.3	
Durango	6,546	18	56	23.74	29.96	+ .03	58.1	— 0.1	82	3	75	32	30	42	46	45	36	56	0.99	— 0.9	9	4,251	nw.	27	s.	29	12	17	1	4.0	
Grand Junction	4,608	43	51	25.40	29.94	— .01	66.6	+ 0.2	88	12	80	44	27	54	35	50	36	39	0.45	— 0.5	5	4,119	e.	29	se.	29	19	8	3	2.8	
Northern Plateau.							60.1	— 1.1										52	0.56	— 0.2									4.3	
Baker City	3,471	48	58	26.46	30.02	+ .03	56.0	— 1.0	86	9	70	32	13	42	42	46	36	55	0.41	— 0.4	5	4,506	nw.	26	nw.	29	17	6	7	3.7	
Boise	2,739	78	86	27.16	29.99	+ .02	61.4	— 0.5	94	10	76	38	18	47	38	48	36	45	0.14	— 0.3	2	3,697	se.	27	sw.	5	19	8	3	3.1	
Lewiston	757	10	51	29.20	30.00	+ .02	62.5	— 1.0	95	10	76	41	18	49	40	....	....	....	0.86	+ 0.2	7	3,200	e.	48	w.	16	12	7	11	5.4	
Pocatello	4,477	46	54	25.50	29.98	+ .02	59.9	— 0.8	85	10	73	34	20	47	38	47	35	46	0.45	— 0.4	5	5,297	se.	30	sw.	12	21	7	2	2.5	
Spokane	1,929	101	110	27.99	30.03	+ .05	57.3	— 1.5	86	10	69	36	13	45	39	50	44	66	0.90	— 0.1	5	3,196	s.	29	w.	16	5	17	8	5.9	
Walla Walla †	1,000	71	79	28.94	30.00	.00	63.6	— 1.8	95	10	75	40	13	52	34	53	43	50	0.63	— 0.3	3	3,531	s.	17	w.	11	11	10	9	5.0	
N. Pac. Coast Reg.							58.0	+ 1.1										78	2.36	— 0.1									5.7	
North Head	211	11	56	29.81	30.03	.00	57.2	+ 1.0	87	8	62	49	9	52	30	53	51	86	2.40	+ 0.6	12	10,019	se.	56	se.	15	8	9	13	6.2	
Port Crescent	259	12	29	29.78	30.06	+ .04	53.8	+ 1.3	82	9	62	33	13	45	32	....	....	....	1.52	— 0.8	7	3,443	w.	17	se.	11	11	3	16	5.9	
Seattle	123	185	224	29.93	30.05	+ .05	58.6	+ 0.7	83	9	65	42	13	52	24	54	52	81	3.39	+ 1.5	11	5,114	se.	33	sw.	16	7	11	12	5.9	
Tacoma	213	113	120	29.80	30.02	.00	58.2	+ 0.6	88	9	66	40	13	50	32	....	....	....	3.44	+ 1.0	9	3,572	sw.	26	sw.	30	9	6	15	6.3	
Tatoosh Island	86	7	57	29.93	30.02	+ .01	54.4	+ 1.4	74	9	59	45	13	50	22	52	51	87	3.21	— 2.9	12	9,328	s.	48	e.	8	7	7	16	6.6	
Portland, Oreg.	153	68	106	29.86	30.02	— .01	62.8	+ 2.2	93	9	72	46	14	54	31	56	51	70	1.73	— 0.1	7	4,319	nw.	27	ne.	8	12	9	9	4.6	
Roseburg	510	9	57	29.48	30.02	.00	61.2	+ 0.7	99	8	76	37	13	46	49	53	47	68	0.33	— 0.2	8	1,908	w.	16	nw.	19	15	10	5	4.2	

TABLE I.—*Climatological data for U. S. Weather Bureau stations, September, 1907*—Continued.

Stations.	Elevation of instruments. Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Pressure, in inches. Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hrs.	Departure from normal.	Temperature of the air, in degrees Fahrenheit. Mean max. + mean min. ÷ 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.	Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches. Total.	Departure from normal.	Days with .01, or more.	Wind. Total movement, miles.	Prevailing direction.	Maximum velocity. Miles per hour.	Direction.	Date.	Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness during daylight, tenths.	Total snowfall.
Mid. Pac. Coast Reg.							62.2	— 1.7										68	0.16	— 0.4										3.6	
Eureka	62	62	80	29.98	30.05	+ .04	55.8	+ 0.9	66	20	60	48	17	52	16	53	51	84	0.63	— 0.5	11	3,628	nw.	27	nw.	28	3	17	10	6.2	
Mount Tamalpais	2,375	11	18	27.55	30.01	+ .07	60.3	.....	84	8	67	46	15	54	20	50	41	56	0.16	— 0.3	3	10,749	nw.	74	nw.	27	22	6	2	1.9	
Point Reyes Light	490	7	18	29.46	29.97	.....	56.9	.....	72	3	61	48	14	53	18	...	...	...	0.14	.....	2	15,268	nw.	74	nw.	28	9	13	8	5.3	
Red Bluff	332	50	56	29.58	29.92	— .01	69.7	— 4.2	97	9	83	51	24	56	39	57	47	50	0.03	— 0.8	1	2,803	se.	11	nw.	3	16	12	2	3.0	
Sacramento	69	106	117	29.87	29.94	+ .05	66.0	— 3.1	92	8	79	50	24	53	37	58	53	69	T.	— 0.4	0	5,611	s.	21	s.	15	28	2	0	1.4	
San Francisco	155	200	204	29.83	30.00	+ .06	60.6	+ 1.3	78	2	66	53	13	55	22	55	52	79	0.11	— 0.2	1	6,191	w.	26	w.	12	13	15	2	3.8	
San Jose	141	78	88	29.85	30.00	.....	61.1	— 3.6	84	20	74	40	13	48	41	...	...	...	0.06	— 0.2	1	.....	nw.	...	.....	...	24	4	2	2.4	
Southeast Farallon	30	9	17	29.98	30.01	.....	57.4	.....	65	16	60	52	20	55	9	...	...	...	0.14	— 0.2	1	10,333	nw.	52	nw.	28	10	13	7	5.2	
S. Pac. Coast Reg.							65.9	— 1.4										69	0.02	— 0.2										2.4	
Fresno	330	67	70	29.59	29.94	+ .07	69.6	— 4.7	98	9	86	49	14	54	39	55	43	48	T.	— 0.3	0	3,994	nw.	17	nw.	28	26	3	1	1.6	
Los Angeles	338	116	123	29.56	29.92	+ .04	67.2	+ 0.7	91	2	79	49	19	56	33	58	54	74	T.	— 0.1	0	3,574	sw.	24	sw.	29	20	9	1	2.8	
San Diego	87	94	102	29.83	29.92	+ .03	65.1	— 1.8	79	2	71	50	26	59	22	60	58	81	0.00	— 0.1	0	4,182	nw.	19	nw.	7	27	3	0	2.3	
San Luis Obispo	201	47	54	29.78	29.99	+ .06	61.8	+ 0.3	83	2	73	42	30	51	33	54	50	74	0.07	— 0.4	2	4,142	nw.	21	w.	28	19	8	3	3.0	
West Indies.																															
Grand Turk	11	6	20	29.96	29.97	+ .02	83.5	.....	92	8	90	67	17	77	...	...	...	...	1.55	.....	14	.....	e.	...	.....	...	...	...	...	...	
San Juan	82	48	90	29.87	29.95	+ .01	80.6	.....	90	18	86	72	4	75	14	76	74	78	4.80	—0.3	24	7,173	e.	33	se.	25	12	15	3	4.5	
Panama.																															
Ancon	74	...	...	.....	29.82	.....	80.6	.....	93	5	88	72	22	73	19	...	...	...	11.14	.....	19	.....	...	...	.....	...	0	3	27	...	
Bas Obispo	40	...	...	.....	29.83	.....	78.6	.....	88	5	85	70	22	72	16	...	...	...	14.71	.....	28	2,732	nw.	19	w.	7	0	8	22	....	
Naos	.....	...	...	.....	29.82	.....	80.8	.....	91	18	87	72	27	74	18	...	...	...	4.97	.....	19	5,026	nw.	34	ne.	12	0	13	17	....	
Christobal	.....	...	...	.....	.....	.....	.....	.....	...	...	...	...	...	...	...	...	...	...	.....	.....	...	.....	...	...	.....	...	...	...	...	....	

* More than one date. † Record incomplete.

TABLE II.—*Climatological record of cooperative observers, September, 1907.*

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Alabama.	°	°	°	*Ins.*	*Ins.*
Ashville	95	49	72.6	11.29	
Auburn	94	56	75.8	3.05	
Bermuda	98	55	75.8	5.82	
Bolligee	103	47	75.6	3.89	
Bridgeport	...	...	...	5.48	
Camphill	99	50	73.2	3.95	
Cedar Bluff	...	...	...	8.29	
Citronelle	99	55	77.1	9.84	
Clanton	99	50	74.8	3.16	
Cordova	95	45	72.9	3.11	
Cullinan	97	46	74.6	6.48	
Decatur	99	49	74.9	5.03	
Demopolis	...	...	...	9.08	
Eufaula	92	57	74.5	8.38	
Evergreen	103	57	78.4	7.51	
Flomaton	100	57	79.3	5.47	
Florence	100	44	73.3	4.09	
Fort Deposit	98	52	76.4	5.18	
Gadsden	99	49	73.3	7.64	
Good Water	98	51	74.8	4.96	
Greensboro	96	54	76.2	5.74	
Guntersville	...	...	...	8.40	
Hamilton	97°	42°	73.2°	3.25	
Highland Home	98	56	75.2	4.22	
Letohatchee	...	...	...	0.67	
Livingston	97	52	74.2	1.64	
Lock No. 4	100	49	73.9	8.41	
Lucy	97	59	76.8	7.96	
Madison Station	98	45	73.1	4.39	
Maplegrove	99	47	71.8	8.13	
Milstead	...	...	...	2.76	
Newbern	104	50	76.5	2.88	
Oneonto	97	45	72.2	9.14	
Opelika	93	53	73.7	3.43	
Ozark	97	60	76.8	12.73	
Prattville	98	55	76.3	2.14	
Pushmataha	104	49	75.2	6.84	
Riverton	97	43	70.3	2.83	
Scottaboro	93	45	71.5	9.71	
Selma	101	52	76.6	1.88	
Spring Hill	91	65	77.2	7.26	
Talladega	98	50	74.5	4.30	
Tallassee	...	...	...	3.30	
Thomasville	98	53	75.2	5.37	
Tuscaloosa	101	48	74.7	6.98	
Tuscumbia	98	45	72.5	3.98	
Tuskegee	101	50	77.9	1.96	
Union Springs	97	58	77.1	3.54	
Uniontown	102	51	76.0	3.87	
Valley Head	98	42	72.2	3.84	
Vienna	...	...	...	3.28	
Wetumpka	100	53	76.8	3.84	
Alaska.					
Circle City	68°	19°	41.0°	.....	.....
Fairbanks	65	19	43.7	.....	.....
Fort Gibbon	...	...	...	2.32	4.0

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Alaska—Cont'd.	°	°	°	*Ins.*	*Ins.*
Juneau	64	34	49.8	17.03	
Killisnoo	61	32	43.3	6.85	
Loring	72	30	53.5	10.14	
North Fork	64	13	38.0	2.00	5.0
Sitka	67	36	54.2	15.75	
St. Michael	52	33	41.0	.....	
Skagway	67	30	50.4	2.47	
Teikhell	75	19	47.1	1.20	
Tonsina	66	16	45.4	0.43	
Arizona.					
Allaire Ranch	...	...	...	1.42	
Arizona Canal Co. Dam	105	50	83.3	0.06	
Aztec	110	58	88.0	0.00	
Benson	98	44	74.6	1.95	
Bisbee	86	43	68.8	1.19	
Bonita	...	...	...	0.55	
Bowie	98	47	76.1	0.00	
Buckeye	107	43	81.0	0.10	
Casa Grande	114	60	87.0	0.25	
Chlarsons Mill	71	42	55.9	1.87	
Clifton	...	...	...	0.94	
Cline	107	42	75.2	0.29	
Cochise*1	90	64	73.9	0.85	
Columbia	103	55	79.0	0.00	
Congress	100	54	80.0	T.	
Douglas	99	37	74.4	1.50	
Dudleyville	96	45	75.9	0.69	
Fish Creek	...	...	...	0.07	
Flagstaff	80	25	55.6	0.92	
Fort Apache	89	34	66.2	0.69	
Fort Huachuca	89	35	67.6	2.21	
Fort Mohave	114	54	84.8	0.00	
Fredonia	99	36	68.1	0.30	
Gila Bend	112	52	87.0	0.00	
Globe	96	44	75.4	0.03	
Grand Canyon	80	27	58.3	4.78	
Greer	...	...	...	1.52	
Holbrook	93	35	66.8	0.43	
Huachuca Reservoir	...	...	...	1.16	
Intake	...	...	...	0.10	
Jerome	93	49	73.4	0.30	
Keams Canyon	84	30	61.9	0.18	
Kingman	102	34	73.5	0.12	
Maricopa	111	48	82.7	0.10	
Mesa	108	46	82.7	0.10	
Mohawk Summit	109	72	91.1	0.00	
Natural Bridge	...	...	...	2.01	
Oracle	88	53	72.7	T.	
Paradise	...	...	...	2.21	
Parker	116	48	82.3	T.	
Phoenix (Ex. Farm)	108	48	82.0	T.	
Picacho*5	104	65	89.9	0.00	
Pinal Ranch	...	...	...	0.26	
Pinto	...	...	...	0.85	
Prescott	90	40	67.2	0.77	
Roosevelt	102	39	76.6	0.21	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Arizona—Cont'd.	°	°	°	*Ins.*	*Ins.*
St. Johns	90	31	62.5	0.32	
St. Michaels	82	30	58.0	0.56	
San Carlos	101	39	75.8	T.	
San Simon	99	38	69.1	T.	
Seligman	90	30	64.0	2.50	
Sentinel	110	58	83.2	T.	
Silverbell	100	58	84.4	0.84	
Tempe	111	43	83.1	T.	
Thatcher	96	40	75.2	0.40	
Tombstone	88	45	70.8	1.66	
Tucson	102	45	80.0	0.80	
Vail *5	100	70	86.8	T.	
Walnut Grove	...	...	...	0.00	
Willcox	94	35	71.8	0.53	
Williams	86	26	59.4	1.52	
Yarnell	...	...	...	0.03	
Arkansas.					
Alicia	96	43	72.0	0.78	
Amity	97	46	74.0	3.11	
Arkadelphia	...	...	...	2.39	
Arkansas City	...	...	...	2.64	
Batesville	103	45	73.2	4.56	
Bee Branch	102	49	75.0	1.05	
Benton	101	47	75.4	3.22	
Bergman	105	41	68.7	2.07	
Brinkley	101	45	74.0	0.96	
Camden	99	49	74.5	2.91	
Center Point	102	50	77.0	1.40	
Conway	97	43	73.2	1.48	
Des Arc	103	43	74.0	0.97	
Dodd City	98	40	70.4	1.12	
Dutton	101	38	71.0	2.00	
Earl	100	44	73.6	0.35	
El Dorado	101	51	77.2	0.92	
England	100	46	75.8	1.93	
Eureka Springs	99	45	71.4	4.02	
Fayetteville	100	43	74.4	1.39	
Forrest City	97	45	73.0	0.52	
Fulton	...	...	...	2.08	
Hardy	97	42	70.7	4.08	
Heber	106	40	73.2	0.45	
Helena	98	50	74.6	1.57	
Hope	105	51	77.6	4.48	
Hot Springs	99	46	73.0	2.95	
Jonesboro	...	...	...	0.72	
Junction	97	48	76.1	0.25	
La Crosse	102	44	73.0	1.84	
Lewisville	104	49	77.2	0.94	
Lutherville	100	42	73.2	1.25	
Luxora	...	...	...	0.98	
Malvern	98	47	72.1	3.70	
Mammoth Spring	98	40	70.0	2.70	
Marvell	99	46	75.0	1.47	
Mena	97	47	74.2	2.93	
Montrose	100*4	45*4	73.3*4	3.55	
Mossville	98	44	69.5	2.52	

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Arkansas—Cont'd.	°	°	°	*Ins.*	*Ins.*
Mount Nebo	91	53	72.4	1.45	
Newport	103	48	73.9	1.50	
Ozark	100	49	75.4	1.70	
Pine Bluff	101	48	74.6	2.63	
Pocahontas	98	47	72.2	2.53	
Pond	97	42	71.3	2.15	
Prescott	102	49	75.8	1.91	
Princeton	103	47	75.4	4.24	
Rogers	98	45	71.8	2.85	
Russellville	102	44	73.0	2.33	
Spielerville	103	49	75.6	1.88	
Stuttgart	99	43	74.0	1.34	
Texarkana	101[1]	56[h]	80.1[i]	0.02	
Warren	100	47	76.0	13.63	
Wiggs	97	40	72.4	2.70	
California.					
Alturas	96	27	56.6	1.09	
Auburn	88	44	66.6	0.00	
Azusa	98	42	67.4	0.00	
Bagdad	108	59	85.8	0.00	
Barstow	105	42	73.2	T.	
Bear Valley	.....	.....	.....	0.60	
Berkeley	79	50	61.2	0.06	
Bishop	91[e]	36[e]	62.6[e]	0.00	
Blocksburg	92	41	61.5	0.54	
Blue Canyon	84	35	60.3	0.00	
Branscomb	85	35	56.2	0.52	
Brush Creek	92	34	60.0	0.03	
Butte Valley	.....	.....	.....	0.25	
Calexico	108	58	82.0	0.00	
Campbell	86	36	60.8	0.09	
Campo	.....	.....	.....	0.00	
Cedarville	92	31	57.2	1.10	
Chico	100	46	71.8	0.04	
Claremont	100	44	70.0	0.00	
Cloverdale	90	41	64.9	0.15	
Colfax	94	38	63.7	0.00	
Colusa	93	41	63.5	0.00	
Crescent City	75	36	55.2	1.59	
Crockers	.....	.....	.....	T.	
Cuyamaca	81	37	59.2	0.00	
Delta	101	40	66.3	1.08	
Dobbins	98	47	70.0	0.02	
Durham	100	44	69.1	0.10	
El Cajon	98	42	69.8	0.00	
Electra	98	47	69.5	0.00	
Elmwood	95	43	68.5	0.00	
Elsinore	104	38	67.4	0.00	
Escondido	89	36	63.6	0.00	
Folsom	101	46	69.6	T.	
Fordyce	.....	.....	.....	0.40	
Fort Ross	77	43	60.2	0.67	
Georgetown	92	40	63.6	T.	
Gold Run	92	41	65.6	0.00	
Greenville	95	26	57.2	T.	
Hanford	100	40	68.8	0.00	
Healdsburg	94[d]	38[d]	64.8[d]	T.	
Heber	114	53	84.1	0.00	
Hollister	86	40	61.8	0.02	
Idyllwild	90	36	62.0	T.	
Indio	114	57	85.2	0.00	
Iowa Hill	90	42	63.4	0.05	
Isabella	.....	.....	.....	0.00	
Jamestown	95	41	64.6	T.	
Jolon	.....	.....	.....	0.08	
Kennedy Gold Mine	.....	.....	.....	0.00	
Kentfield	.....	.....	.....	0.11	
Kernville	.....	.....	.....	0.00	
King City	90	42	63.8	0.00	
LaPorte	83	30	54.4	0.19	
Laytonville	.....	.....	.....	0.06	
Le Grande	97	50	71.0	T	
Lemoncove	104[d]	43	70.9[d]	0.00	
Lick Observatory	82	38	57.5	0.01	
Livermore	90	42	66.2	T.	
Lodi	88	44	63.8	0.00	
Lone Pine	91	35	63.3	T.	
Los Gatos	83	40	61.0	0.06	
Magalia	77	39	61.1	0.30	
Mammoth	116	54	86.7	0.00	
Marysville	97	50	73.8	0.00	
Merced	94	48	66.4	0.00	
Mill Creek	80[b]	36[b]	57.4[b]	T.	
Mills College	.....	.....	.....	0.01	
Milo	.....	.....	.....	0.00	
Milton (near)	93	49	67.7	T.	
Mojave	102	61	82.6	0.00	
Mokelumne Hill	91	42	66.2	T.	
Mono Ranch	91	34	60.3	T.	
Montague	94	32	60.4	0.74	
Monterio	100	40	70.8	0.00	
Monumental	90	34	58.0	3.22	
Mount St. Helena	.....	.....	.....	0.12	
Napa	88	41	65.2	0.01	
Needles	.....	.....	.....	0.00	
Nevada City	92	33	61.1	0.03	
Newcastle	97	45	67.8	0.10	
Newman	96[g]	43[g]	68.9[g]	T.	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
California—Cont'd.	°	°	°	*Ins.*	*Ins.*
Nimshew	94	38	63.6	0.25	
North Bloomfield	89	35	59.2	0.15	
Oakland	80	50	62.1	0.04	
Ojai Valley	100	40	65.8	T.	
Orland	100	42	70.8	T.	
Orleans	107	45	71.2	0.63	
Oroville (near)	99	47	69.0	0.39	
Ozena	.....	.....	.....	0.00	
Palermo	99	43	68.2	0.60	
Pilot Creek	.....	.....	.....	T	
Pine Crest	88	49	68.1	0.05	
Placerville	88	38	60.0	0.00	
Point Lobos	72	53	61.1	0.22	
Porterville	99	44	69.2	0.00	
Poway	94	38	68.5	T.	
Quincy	90	29	57.2	0.14	
Redding	96	51	70.7	0.21	
Redlands	101	45	70.0	0.00	
Reedley	100	42	68.4	T.	
Represa	.....	.....	.....	0.05	
Rialto	104	49	74.2	0.00	
Riverside	102	44	69.4	0.00	
Rocklin	97	42	67.0	0.03	
Sacramento	82	45	63.2	T.	
Salinas	85	41	60.2	0.13	
San Bernardino	104	40	69.4	0.00	
San Jacinto	106	39	71.1	0.00	
San Miguel Island	.....	.....	.....	0.33	
Santa Barbara	85	46	64.1	T.	
Santa Clara College	86	38	61.8	0.12	
Santa Cruz	85	40	60.8	0.40	
Santa Maria	80	43	61.8	0.06	
Santa Monica	81	46	60.7	0.00	
Santa Rosa	88	38	61.7	0.46	
Sausalito	.....	.....	.....	0.11	
Shasta	107	45	74.2	0.07	
Sierra Madre	95	47	68.7	0.00	
Sisson	91	33	55.4	0.00	
Stirling City	90	33	63.6	0.00	
Stockton	84	49	65.0	T.	
Storey	98	41	66.2	0.00	
Summerdale	84	33	58.0	0.02	
Summit	77	21	45.2	0.06	T.
Susanville	87	30	56.2	0.50	
Susquoc Ranch	.....	.....	.....	0.00	
Tamarack	76	24	48.9	0.83	1.0
Towle	89	37	59.8	0.00	
Truckee	84	32	56.5	0.00	
Tulare	89	41	63.8	0.00	
Tustin (near)	.....	.....	.....	0.00	
Ukiah	100	37	62.9	0.01	
Upper Lake	97	38	64.8	T.	
Upper Mattole	.....	.....	.....	0.53	
Vacaville	95	40	67.1	0.01	
Wasco	98	33	63.4	0.00	
Westpoint	.....	.....	.....	T.	
Wheatland	93	47	67.4	0.09	
Willits	99	20	59.6	0.10	
Willows	95	47	67.3	0.02	
Woodleaf	.....	.....	.....	0.35	
Woodside	78	43	60.2	0.23	
Yosemite	94	32	59.8	T.	
Colorado.					
Akron	.....	.....	.....	1.86	
Alamosa	87[f]	25[f]	54.9[f]	0.38	
Antelope Springs	75	19	47.0	.....	1.2
Arriba	87	30	62.4	0.85	
Ashcroft	72	25	47.8	1.88	2.5
Blaine	95	35	70.0	0.87	
Boulder	86	32	63.9	1.06	1.0
Breckenridge	71	21	46.8	1.48	
Buena Vista	75[e]	26[e]	50.9[e]	0.41	
Burlington	96	31	64.9	0.50	
Canyon	89	40	67.4	.....	
Cascade	.....	.....	.....	3.27	2.8
Castle Rock	89	27	57.0	0.95	
Cheesman	83	32	58.4	0.61	1.0
Cheyenne Wells	98	32	64.8	1.28	
Chromo	78	20	52.8	2.09	1.0
Collbran	85	27	59.2	1.25	
Colorado Springs	83	33	60.2	0.68	T.
Cope	89	32	63.6	2.10	.....
Corona	61	19	39.3	1.73	6.1
Cripple Creek	.....	.....	.....	0.87	2.0
Delta	95	32	63.3	1.35	
Dunkley	76	20	51.6	1.68	T.
Eads	95	33	66.7	0.47	
Eagle	82	22	55.4	0.98	
Eureka	.....	.....	.....	3.05	2.0
Fort Collins	86	31	58.7	0.58	1.5
Fort Morgan	89	33	60.5	0.95	
Frances	75	26	51.7	1.74	3.5
Fruita	89	32	63.2	0.38	
Garnett	82	21	54.9	0.31	
Gladstone	.....	.....	.....	2.88	T.
Gleneyre	87	30	59.4	0.85	
Glenwood	81	20	55.2	1.17	
Gothic	69	22	45.1	2.63	5.0

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Colorado—Cont'd.	°	°	°	*Ins.*	*Ins.*
Grand Lake	.....	.....	.....	2.17	1.5
Grand Valley	88	31	61.0	1.24	
Greeley	89	32	61.6	0.18	
Gunnison	80	20	51.8	0.97	
Hamps	86	30	59.9	0.74	
Hoehne	92	29	62.6	0.06	
Holly	95	35	68.3	1.02	
Holyoke	.....	.....	.....	1.18	
Idaho Springs	79	28	55.2	0.55	2.0
Kossler	.....	.....	.....	1.58	3.0
Lake City	76	26	52.3	0.88	T.
Lake Moraine	66	27	48.0	1.30	
Lamar	99	36	69.6	1.99	
Laporte	.....	.....	.....	0.86	T.
Las Animas	99	37	70.0	0.90	
Leroy	88	31	61.6	1.88	T.
Limon	86	30	62.6	1.28	T.
Longs Peak	73	17	50.2	.....	.....
Lujane	84	36	61.0	0.42	
Manassa	79	26	54.4	0.50	T.
Mancos	79	26	56.0	1.19	
Meeker	83	25	55.6	3.12	
Pagoda	84	24	55.7	1.95	
Pagosa Springs	79	23	53.8	2.08	1.0
Paonia	87	35	62.0	0.92	
Platte Canyon	.....	.....	.....	1.04	
Power House	80	31	55.8	2.03	
Rangely	79	25	54.8	1.28	
River Portal	83	34	58.1	0.68	
Rocky Ford	96	36	66.5	0.33	
Saguache	80	22	56.2	0.35	
Salida	81	26	56.2	0.74	
San Luis	78	26	53.6	0.57	
Santa Clara	82	30	57.3	0.71	
Sapinero	74	24	50.2	1.24	T.
Sheridan Lake	94	31	63.6	0.83	
Silverton	73	22	48.0	2.69	1.5
Stonewall	.....	.....	.....	0.58	
Terminal Dam	.....	.....	.....	2.34	1.0
Trinidad	89	38	64.6	0.12	
Victor	71	30	52.2	0.68	0.1
Vilas	.....	.....	.....	1.50	
Wagon Wheel Gap	78	17	48.3	1.36	T.
Waterdale	89	32	59.8	0.67	
Westcliffe	79	22	54.6	0.72	
Whitepine	69	23	46.0	1.22	4.0
Wray	96	35	63.2	1.27	
Yuma	.....	.....	.....	1.44	T.
Connecticut.					
Bridgeport	88	38	66.2	8.04	
Canton	85	32	62.5	10.50	
Colchester	86	34	63.9	5.20	
Falls Village	.....	.....	.....	12.43	
Hawleyville	84	38	64.2	9.68	
Lake Konomoc	.....	.....	.....	3.62	
New London	84	42	65.8	5.93	
North Grosvenor Dale	86	32	62.0	8.71	
Norwalk	86	35	64.8	5.98	
Southington	85	34	63.6	11.90	
South Manchester	.....	.....	.....	10.04	
Storrs	83	35	62.0	9.71	
Voluntown	86	30	63.0	6.81	
Wallingford	.....	.....	.....	6.88	
Waterbury	88	34	65.0	9.82	
West Cornwall	85	34	61.0	12.22	
West Simsbury	.....	.....	.....	9.83	
Delaware.					
Delaware City	.....	.....	.....	6.82	
Dover	90	35	69.8	8.17	
Milford	93	41	71.2	6.32	
Millsboro	93	40	69.6	5.04	
Newark	89	40	68.2	8.06	
Seaford	90	40	69.1	3.95	
District of Columbia.					
West Washington	94	41	71.0	7.71	
Florida.					
Apalachicola	92	68	79.0	12.87	
Arcadia	95	69	81.3	7.57	
Archer	97	65	79.3	12.74	
Avon Park	94	68	81.2	4.59	
Bartow	97	66	81.0	5.93	
Bonifay	98[e]	62[e]	78.8[e]	8.87	
Brooksville	98	66	81.0	6.72	
Carrabelle	93	68	80.4	13.25	
Clermont	97	69	82.0	6.59	
De Funiak	99	61	78.0	13.49	
Deland	95	64	81.1	.....	
Eustis	98	66	81.1	4.20	
Federal Point	96	67	80.0	7.99	
Fenholloway	100	65	79.7	10.68	
Fernandina	94	67	79.4	8.99	
Flamingo	95	73	84.6	4.86	
Fort Meade	96	66	80.4	6.84	
Fort Myers	91	68	79.6	4.97	
Gainesville	99	67	80.0	10.39	
Galt	100	60	78.8	17.43	
Grasmere	95	69	80.4	.....	
Huntington	95	67	80.4	7.39	

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
***Florida*—Cont'd.**	°	°	°	*Ins.*	*Ins.*
Hypoluxo	94	69	81.3	3.80	
Inverness	99	66	79.6	9.40	
Jasper	97	65	80.0	8.08	
Johnstown	97[d]	65[d]	80.8[d]	11.95	
Kissimmee	97	69	81.2	5.79	
Lake City	97	66	79.1	6.85	
Macclenny	100	64	79.2	8.38	
Madison	97	65	79.0	7.55	
Malabar	96	68	82.2	2.94	
Manatee	97	68	80.8	6.12	
Marianna	100	62	79.6	11.94	
Merritts Island	92	72	80.4	5.61	
Miami	93	69	82.1	3.76	
Molino	102	56	77.3	15.00	
Monticello	93	64	76.8	13.14	
Mount Pleasant	99	60	78.2	9.86	
New Smyrna	97	67	79.8	4.27	
Ocala	101	66	80.7	7.98	
Orange City	96	66	80.2	4.93	
Orlando	96	67	81.0	5.15	
Panasoffkee	96	65	79.8	7.57	
Rockwell	102[d]	68[e]	82.4[d]	5.70	
St. Andrew	95[f]	69	79.8[e]	11.91	
St. Augustine	93	60	78.4	6.21	
St. Leo	94	66	80.2	9.08	
Switzerland	96	65	79.0	7.86	
Tallahassee	94	66	77.5	10.30	
Tarpon Springs	94	65	79.3	8.66	
Wausau	101	61	79.0	20.05	
Georgia.					
Adairsville	91	51	72.0	4.56	
Albany	96	60	78.4	9.12	
Allapaha	95	60	78.0	6.63	
Americus	95	59	76.0	8.45	
Athens	89	56	73.2	6.81	
Bainbridge	101	58	78.2	7.16	
Blakely	100[f]	58[f]	78.8[f]	13.16	
Brunswick	97	65	80.6	4.55	
Camak	96	55	74.0	6.31	
Carlton	.....	.....	.....	6.04	
Clayton	87	46	68.8	8.92	
Columbus	100	57	79.0	3.68	
Covington	.....	.....	.....	4.31	
Cuthbert	96	56	76.6	8.12	
Dahlonega	92	49	70.1	7.24	
Diamond	84	46	68.0	8.36	
Dublin	.....	.....	.....	5.33	
Dudley	95	57	77.0	7.70	
Eastman	102	58	79.3	7.76	
Eatonton	97	51	70.5	7.28	
Elberton	97	56	74.7	6.32	
Experiment	94	57	74.4	3.76	
Fleming	100	63	79.1	6.12	
Fort Gaines	92	61	76.2	8.18	
Gainesville	93	58	72.0	3.77	
Gillsville	93	48	73.8	4.82	
Glenville	96	63	78.2	8.11	
Greenbush	91	51	71.3	6.74	
Greensboro	93	55	76.8	7.60	
Griffin	96	51	76.2	5.22	
Harrison	95	56	76.4	6.22	
Hawkinsville	105	55	77.9	4.95	
Helena	94	61	77.8	8.85	
Lisbon	99	58	76.5	6.79	
Lost Mountain	96	49	73.2	3.85	
Lumpkin	98	55	76.2	4.92	
Marshallville	100	53	76.6	6.38	
Mauzy	100	62	80.8	7.99	
Milledgeville	100	52	76.4	8.24	
Millen	99	59	77.6	5.63	
Montezuma	.....	.....	.....	7.28	
Monticello	98	54	76.0	7.40	
Morgan	96	60	77.2	10.87	
Newnan	99	51	74.4	2.29	
Oakdale	.....	.....	.....	3.75	
Point Peter	96[b]	55[c]	73.0[c]	6.47	
Poulan	94	57	77.1	9.12	
Putnam	95	54	77.6	4.84	
Quitman	95	64	77.8	11.88	
Ramsey	94	49	74.8	7.92	
Rome	100	48	73.1	3.88	
St. George	94	64	77.4	5.69	
St. Marys	97	63	79.8	6.12	
Screven	94	62	78.9	2.80	
Statesboro	94	61	77.5	5.29	
Talbotton	101	52	76.4	4.22	
Tallapoosa	98	50	71.3	2.51	
Toccoa	90	50	69.8	4.62	
Valdosta	99	65	81.6	5.83	
Valona	95[c]	63[c]	78.6[c]	4.01	
Washington	97	55	75.0	5.95	
Way Cross	102	62	79.9	4.67	
Waynesboro	93	61	76.6	7.37	
West Point	98	55	74.0	3.14	
Woodbury	100	49	75.0	3.15	
Idaho.					
Albion	91	25	59.2	T.	
American Falls	85	26	57.6	1.02	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
***Idaho*—Cont'd.**	°	°	°	*Ins.*	*Ins.*
Blackfoot	85	26	56.6	0.51	
Bonners Ferry	84	28	54.9	2.31	
Buhl	92	26	62.6	1.14	
Burke	85	29	51.6	2.77	T.
Caldwell	93	30	59.9	0.14	
Cambridge	97	30	60.3	0.30	
Chesterfield	83	18	51.8	0.42	
Dent	95	36	61.5	0.71	
Driggs	79	21	51.7	0.75	
Ellerslie	92	31	60.6	0.17	
Emmett	93	33	60.6	0.07	
Forney	86	17	50.6	0.44	
Garnett	103	37	66.1	0.05	
Grace	86	28	57.8	0.18	
Hot Springs	93	32	61.4	0.30	
Idaho Falls	84	27	56.6	0.75	
Kellogg	85	33	56.0	1.53	
Lake	74	28	51.2	0.50	
Lakeview	80[a]	35	.....	2.70	
Landore	80	23	51.0	1.02	
Lardo	81[c]	22[c]	50.0[c]	0.23	
Lost River	80[c]	23[b]	54.5[c]	0.38	
Meadows	90	25	52.6	0.80	
Milner	89[d]	32[d]	60.9[d]	0.91	
Moscow	85	37	57.4	0.87	
Mountain Home	94	26	60.0	0.15	
Murray	82	28	52.6	1.92	
Murtaugh	90[f]	27[a]	57.9[d]	0.81	
Nevens Ranch	.....	.....	.....	0.15	
Oakley	91	25	58.4	0.90	
Orofino	98	32	62.4	0.45	
Paris	92	25	55.0	0.50	
Payette	93	29	60.4	0.22	
Pollock	90	34	60.6	0.49	
Poplar	.....	.....	.....	0.16	
Porthill	79	30	54.3	3.40	
Roosevelt	72[f]	24[f]	46.0[f]	1.73	
Rupert	90	31	59.8	0.96	
St. Maries	86	34	56.8	0.61	
Salem	.....	.....	.....	0.57	
Salmon	85	25	54.9	0.21	
Standrod	.....	.....	.....	0.69	
Sugar City	81	26	53.6	0.64	
Twin Falls	89	28	57.8	0.70	
Vernon	82	25	54.0	0.03	T.
West Lake	.....	.....	.....	1.00	
Weston	86	26	56.6	0.41	
Illinois.					
Albion	95	40	68.4	0.32	
Aledo	89	32	63.8	2.02	
Alexander	94	32	66.4	1.09	
Antioch	93	35	62.2	5.43	
Astoria	89	33	64.2	2.03	
Aurora	91	33	61.4	6.08	
Benton	100	42	71.5	1.00	
Bloomington	94	34	66.2	2.69	
Bushnell	94	35	66.5	1.34	
Cambridge	93	32	64.3	4.05	
Carlinville	95	36	68.0	0.63	
Carlyle	.....	.....	.....	0.89	
Carrollton	92	36	67.1	1.55	
Charleston	92	36	66.0	0.72	
Chester	95	45	71.8	2.22	
Clane	97	38	69.8	1.03	
Coatsburg	91	35	65.6	1.92	
Cobden	97	43	70.6	0.79	
Colchester	93	34	66.4	1.29	
Decatur	93	35	66.4	2.08	
Dixon	94	31	61.3	4.95	
Dwight	92	35	64.1	6.34	
Equality	98	39	70.8	1.67	
Flora	95	37	67.8	0.95	
Friendgrove	90	40	67.2	0.45	
Galva	92	32	63.6	2.69	
Grafton	.....	.....	.....	0.55	
Greenville	92	38	66.6	0.79	
Griggsville	93	37	67.5	2.24	
Halfway	93	40	70.0	0.79	
Havana	96	40	68.8	1.53	
Henry	91	33	64.2	4.51	
Hillsboro	96	38	66.8	0.96	
Hoopeston	90	36	64.9	5.09	
Joliet	90	38	63.0	6.13	
Kishwaukee	92	33	62.2	5.70	
Knoxville	90	35	65.5	2.08	
La Grange	92	35	61.8	5.72	
La Harpe	92	32	64.8	1.95	
Lanark	92	28	60.6	6.20	
Lincoln	93	38	66.4	2.63	
Loami	.....	.....	.....	1.22	
McLeansboro	93	41	67.5	1.03	
Martinsville	95	36	66.3	0.40	
Martinton	94	35	64.2	4.17	
Mascoutah	98	38	68.2	1.74	
Minonk	91	33	63.8	3.82	
Monmouth	96	33	65.8	1.76	
Morrison	89	33	62.2	5.75	
Morrisonville	93	36	66.2	1.02	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
***Illinois*—Cont'd.**	°	°	°	*Ins.*	*Ins.*
Mount Carmel	.....	.....	.....	0.64	
Mount Vernon	95	41	69.0	0.97	
New Burnside	98	34	67.4	1.28	
Olney	95	39	68.4	1.35	
Ottawa	88	36	63.6	4.94	
Palestine	93	38	67.4	0.60	
Pana	93	36	66.6	1.01	
Paris	92[c]	36[d]	66.4[d]	0.70	
Peoria	.....	.....	.....	2.94	
Philo	92	33	64.4	0.58	
Pontiac	90	40	64.4	4.59	
Rantoul	93	34	65.0	2.26	
Raum	98	43	70.2	2.09	
Riley	91	31	61.4	4.90	
Robinson	93	38	67.6	1.74	
Rockford	92	33	60.8	4.84	
Rushville	92	35	67.0	0.89	
St. Charles	93	33	62.6	6.49	
St. John	96	40	68.6	1.65	
Streator	95	33	63.8	5.58	
Sullivan	95	36	66.8	0.61	
Sycamore	95	32	61.6	7.39	
Tilden	97	40	69.2	3.99	
Tiskilwa	90	33	63.2	3.69	
Tuscola	93	34	66.3	1.17	
Urbana	92	36	65.0	0.94	
Vernon	93	42[c]	67.1[b]	0.51	
Walnut	94[c]	34[d]	62.8[d]	4.84	
Warsaw	.....	.....	.....	1.76	
Windsor	96	34	66.3	1.57	
Winnebago	93	32	61.4	6.45	
Yorkville	92	33	62.6	5.21	
Zion	85	31	60.7	5.05	
Indiana.					
Anderson	86	37	64.9	2.27	
Auburn	86	28	60.2	4.31	
Bloomington	92	40	67.1	2.52	
Bluffton	88	31	63.2	2.92	
Butlerville	92	40	67.6	2.62	
Cambridge City	88	34	64.0	3.47	
Columbus	91	36	67.0	2.38	
Connersville	87	35	65.2	3.69	
Delphi	92	33	63.7	3.94	
Elkhart	93	34	63.1	3.45	
Eminence	89	37	65.0	1.73	
Farmersburg	89	38	65.8	2.07	
Farmland	85	34	63.2	3.40	
Fort Wayne	90	30	64.3	2.66	
Franklin	90	36	65.7	1.76	
Greenfield	89	38	66.5	2.41	
Greensburg	90	38	67.3	1.49	
Hammond	87	35	64.0	4.54	
Holland	96	41	70.2	2.93	
Huntington	90	44	64.8	3.16	
Jeffersonville	91	41	69.6	1.39	
Judyville	92	31	63.2	3.03	
Knox	88	34	62.8	4.34	
Kokomo	90	33	63.4	2.51	
La Fayette	90	37	64.6	3.46	
Laporte	91	30	62.0	6.60	
Lima	88	32	61.6	4.07	
Logansport	95	35	65.0	2.71	
Madison	98	40	70.1	2.38	
Marengo	91	38	67.8	5.07	
Marion	88	33	64.2	2.66	
Markle	88	30	63.7	3.25	
Mauzy	89[c]	35[c]	66.2[c]	3.00	
Moores Hill	89	39	68.4	2.41	
Mount Vernon	93	43	70.2	3.32	
Northfield	87	29	62.5	1.44	
Paoli	91	34	67.0	4.42	
Plymouth	91	32	62.2	4.02	
Princeton	95	38	68.4	1.35	
Rensselaer	89	34	63.1	3.10	
Richmond	90	35	65.2	2.82	
Rochester	85	37	63.2	4.73	
Rockville	89	37	65.2	2.50	
Rome	95	40	71.2	2.76	
Salamonia	88	30	63.6	2.12	
Salem	91	36	67.2	4.52	
Seymour	89[c]	38[c]	67.1[c]	2.72	
Shelbyville	91	37	66.3	1.57	
South Bend	91	35	63.0	4.82	
Terre Haute	92	40	68.1	2.63	
Veedersburg	95[a]	37[b]	68.6[b]	1.45	
Vevay	96	42	70.8	2.10	
Vincennes	97	38	69.2	0.75	
Washington	91	40	66.8	1.24	
Worthington	91	36	67.1	1.64	
Indian Territory.					
Ada	103	49	76.6	2.04	
Ardmore	103	47	77.4	3.35	
Calvin	.....	.....	.....	6.10	
Chickasha	105	45	76.6	0.85	
Durant	103	46	76.0	1.13	
Fairland	102	43	73.8	1.17	
Fort Gibson	.....	.....	.....	1.70	
Hartshorne	.....	.....	.....	1.90	

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Indian Territory—Cont'd.	°	°	°	*Ins.*	*Ins.*
Healdton	104	44	74.4	4.29	
Holdenville	105	47	74.5	4.60	
Idabel	101	50	76.8	1.04	
Marlow	103	47	75.4	1.45	
Muskogee	107	47	76.1	2.40	
Okmulgee	106e	46e	76.1e	4.05	
Pauls Valley	103	44	74.4	3.20	
Ravia	105	51	77.6	2.57	
South McAlester	104	49	77.8	2.72	
Tulsa	107	48	75.0	1.24	
Vinita	100	42	72.8	1.62	
Wagoner	107	45	76.0	1.70	
Webbers Falls	107	44	75.4	3.53	
Iowa.					
Afton	92	35	65.0	2.35	
Albia	90	32	63.6	1.60	
Algona	86	29	60.6	1.51	
Allerton	93	32	64.9	1.93	
Alta	89	34	61.0	1.45	
Alton	88	32	61.1	2.92	
Amana	88	31	63.2	4.18	
Ames	90	28	62.4	2.14	
Atlantic	93	27	63.0	3.00	
Audubon	90	27	61.8	1.68	
Baxter	89	30	62.3	2.44	
Bedford	96	29	64.5	2.25	
Belle Plaine	87	31	62.6	3.85	
Bloomfield	91f	34	65.0e	2.96	
Bonaparte	90	33	64.4	1.99	
Boone	90	34	62.8	2.66	
Britt	88	28	59.9	1.82	
Buckingham				3.32	
Burlington	93	36	65.6	1.89	
Carroll	87	30	61.2	2.22	
Cedar Rapids	90	34	63.0	5.22	
Chariton	92	31	64.4	2.07	
Clarinda	98	33	64.4	2.95	
Clear Lake	87	35	62.0	1.70	
Clinton	92	33	61.4	4.47	
Columbus Junction	90	33	64.7	1.62	
Corning	91	30	63.4	2.30	
Corydon	94	34	65.7	1.92	
Creston	89	31	62.4	2.51	
Cumberland				3.38	
Decorah	86	31	60.0	5.75	
Delaware	87	32	61.2	4.80	
Denison	88	30	62.8	2.43	
De Soto	90	32	63.6	3.14	
Dows	88	26	60.6	2.13	
Earlham	89	33	64.8	3.08	
Elkader	89	29	62.2	4.07	
Elliott	94	32	65.2	2.80	
Elma	82	25d	58.5b	2.63	
Estherville	87	31	58.8	1.95	
Fayette	85	27	59.7	3.58	
Forest City	88	31	60.0	1.73	
Fort Dodge	91	30	61.4	1.97	
Fort Madison				1.56	
Gilman				2.98	
Grand Meadow	83	32	60.6	4.64	
Greene	87	30	61.2	2.68	
Greenfield	89	34	63.2	3.12	
Grinnell	91	28	63.8	2.09	
Grundy Center	90	31	62.6	2.81	
Guthrie Center	90	30	63.8	2.38	
Hampton	89	33	62.4	2.66	
Hancock	89	33	63.4	3.46	
Harlan	92	29	63.0	2.14	
Humboldt	87	31	61.6	1.65	
Independence	88	30	61.5	4.04	
Indianola	90	35	64.4	2.03	
Inwood	90	26	60.6	3.38	
Iowa City	92	33	63.1	2.85	
Iowa Falls	87	28	60.4	2.01	
Jefferson	93	31	63.8	2.71	
Keosauqua	94	33	64.0	2.78	
Lacona				4.96	
Larrabee	88e	32e	60.2e	1.98	
Le Claire				4.84	
Le Mars	86	30	60.9	1.59	
Lenox	91	34	65.0	3.16	
Leon	91	38	66.6	2.22	
Little Sioux	93	31	64.9	1.96	
Logan	92	31	63.2	0.73	
Maple Valley				2.36	
Marshalltown	89	30	62.1	2.59	
Mason City	84	30	61.3	2.08	
Mount Ayr	96	36	65.6	2.85	
Mount Pleasant	91	34	65.5	2.04	
Mount Vernon	90	32	62.9	4.65	
Murray	93	33	65.0	1.89	
Nevada				2.41	
New Hampton	82	28	59.2	3.75	
Northwood	83e	32d	60.6d	1.48	
Odebolt	92	32	62.8	4.00	
Olin	88e	31e	63.1e	5.71	
Onawa	93	38	65.6	2.02	
Osage	86	29	60.2	3.98	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Iowa—Cont'd.	°	°	°	*Ins.*	*Ins.*
Pacific Junction	91	33	64.0	3.99	
Pella	92e	36e	66.0e	2.70	
Perry	90	32	62.8	2.37	
Plover	89	26	59.2	2.85	
Pocahontas	90	30	61.4	1.97	
Ridgeway	90	28	61.2	6.06	
Rockwell	90	37	63.0	2.51	
Sac City	87	32	61.9	2.80	
St. Charles	92	35	65.2	1.99	
Sheldon	89	29	61.4	3.03	
Sibley	86	30	58.0	3.45	
Sigourney	91	32	64.8	2.71	
Sioux Center	86	33	60.6	2.51	
Stockport	90	35	64.9	2.06	
Storm Lake	95	31	63.8	1.94	
Stuart	90	36	63.8	1.68	
Thurman	98	34	65.2	4.75	
Tipton	93	37	65.0	3.74	
Toledo	88	31	62.4	2.70	
Wapello	88	37	65.3	2.21	
Washington	89	32	63.4	1.38	
Washta	88	27	60.4	1.62	
Waterloo	88	22	63.1	3.26	
Waukee	92	34	63.8	3.55	
Waverly	84	32	61.4	2.65	
Webster City	91	27	62.6	2.11	
West Bend	87	30	60.2	1.84	
Whitten	89	30	62.0	2.63	
Wilton	90	37	63.6	3.38	
Winterset	89	36	64.5	2.45	
Zearing	90	28	62.4	2.10	
Kansas.					
Abilene				5.38	
Alton	99	36	69.2	3.26	
Anthony	101	40	74.6	0.55	
Ashland	99	36	71.8	1.48	
Atchison	96	40	69.2	3.22	
Baker	93	39	66.6	3.00	
Burlington	103	42	70.6	1.58	
Chapman	99	41	69.9	4.52	
Cimarron	96	34		0.70	
Clay Center	100	37	69.8	2.85	
Colby	96	33	67.3	2.06	
Coldwater	96	38	72.0	0.39	
Columbus	98	45	71.4	1.04	
Coolidge	95	34	68.7	1.22	
Cottonwood Falls	99	40	70.9	1.89	
Cunningham	100e	40e	72.8e	0.71	
Dresden	97	36	67.7	1.02	
Eldorado	99	41	72.1	0.96	
Ellinwood	96	35	69.6	2.44	
Ellsworth	96	36	69.2	4.22	
Emporia	98	43	69.7	2.70	
Enterprise	99	41	71.3	4.45	
Eureka				1.63	
Fall River	99	40	71.6	0.87	
Farnsworth	97	36	69.4	1.24	
Forest Hill	95	39	69.4	0.88	
Fort Scott	99	39	69.2	2.04	
Frankfort	101	35	67.6	3.36	
Garden City	96	35	70.2	2.59	
Garnett	96	42	69.9	2.60	
Goodland	95	33	68.5	1.11	
Greensburg	94	37	70.0	2.89	
Grenola	100	43	70.6	0.64	
Hanover	99e	38	67.8d	3.68	
Harrison	96	37	67.2	4.86	
Hays	98	32	68.9	1.75	
Hill City				1.72	
Horton	94	42	67.3	4.12	
Howard	104	44	71.8	1.70	
Hoxie	97	35	69.1	2.12	
Hutchinson	96	36	71.2	1.36	
Independence	100	47	72.4	2.16	
Jetmore	97	34	70.9	0.85	
Jewell	100e	37f	68.9d	2.70	
La Crosse	102	33	70.4	2.28	
Lakin		36		2.13	
Larned	95	32	67.9	2.39	
Lebanon				3.60	
Lebo	97	43	69.5	2.76	
Liberal	100	38	71.8	0.58	
Macksville	94	33	67.9	1.18	
McPherson	99	37	72.4	1.15	
Madison	99	38	69.8	1.85	
Manhattan	99	38	68.2	2.91	
Manhattan Agr. College	97	38	69.6	3.11	
Minneapolis	96	39	69.0	3.27	
Moran	101	43	71.5	0.88	
Ness City				1.26	
Newton	97	38	71.2	3.36	
Norton	98	32	67.2	2.06	
Norwich	97	42	73.8	0.63	
Oberlin				1.67	
Olathe	93	42	68.4	2.68	
Osage City	98	38	67.6	3.16	
Oswego	100	44	72.0	1.03	
Ottawa	94	37	68.0	2.14	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Kansas—Cont'd.	°	°	°	*Ins.*	*Ins.*
Paola	97	41	68.8	1.04	
Plainville				2.85	
Pleasanton	97	42	70.0	2.19	
Pratt	95	37	70.3	1.36	
Republic	96	39	67.7	4.40	
Rome	103	40	73.2	1.60	
Russell	98	36	68.8	2.07	
Salina	99	38	70.4	3.68	
Scott	95	33	69.4	2.11	
Sedan	96	44	70.4	1.26	
Toronto	99	37	72.4	0.67	
Ulysses	95	37	70.3	2.33	
Valley Falls	92	40	67.4	3.07	
Wakeeney	96	38	69.2	1.74	T.
Wakeeney (near)				1.61	
Wallace	98	32	67.4	0.86	
Walnut	100	43	71.2	1.39	
Winfield	96	44	72.5	1.20	
Yates Center	101	43	71.8	1.10	
Kentucky.					
Alpha	87	47	69.0	4.60	
Anchorage	92	44	69.4	1.10	
Bardstown	95	40	71.0	3.46	
Beattyville	91	38	68.6	3.32	
Beaver Dam	95	35	68.6	0.99	
Berea	91	35	68.6	3.52	
Bowling Green	97	41	72.0	3.27	
Burnside	93	40	70.4	4.98	
Cadiz	95	39	70.1	2.49	
Calhoun	98	41	71.1	2.84	
Catlettsburg	95i	44i	72.4i	2.28	
Earlington	102	38	68.4	2.68	
Edmonton	91	37	68.8	3.51	
Eubank	89	39	66.9	6.76	
Falmouth				2.01	
Farmers	90	36	67.5	4.57	
Frankfort	87	39	68.5	0.95	
Franklin	93	40	70.5	3.17	
Greensburg	93	35	67.3	3.63	
Hopkinsville	97	40	69.3	2.99	
Irvington	89	43	69.8	2.59	
Leitchfield	90	41	68.2	2.51	
Loretto	93	36	70.6	2.74	
Lynnville	96	41	70.0	2.51	
Marion	95	43	70.6	5.04	
Maysville	94	40	69.5	2.38	
Middlesboro	91	42	70.2	5.23	
Mount Sterling	87	38	67.5	3.37	
Owensboro	91	42	68.2	2.26	
Owenton	88	42	67.9	2.96	
Paducah	97	50	74.6	2.49	
Richmond	91	40	69.2	2.46	
St. John	91	39	67.4	4.39	
Scott	92	40	69.0	1.40	
Shelby City	90	42	68.3	2.89	
Shelbyville	89	35	67.4	2.43	
Taylorsville	89	38	67.8	2.28	
West Liberty	90	40	69.4	3.38	
Williamsburg	92	40	69.2	5.45	
Williamstown	89	41	67.6	1.91	
Louisiana.					
Abbeville	101	58	78.8	6.36	
Alexandria	102	53	79.7	3.00	
Amite	99	55	77.4	6.80	
Baton Rouge	97	55	76.6	3.24	
Burnside	95	58	77.6	1.90	
Calhoun	99	50	77.2	1.45	
Cameron	93	59	78.4	5.73	
Cheneyville	98	54	76.6	2.10	
Clinton	91	56	76.2	3.26	
Collinston	96	50	74.4		
Covington	98	58	78.6	1.91	
Donaldsonville	98	60	79.8	2.32	
Farmerville	96m	55f	78.6j	0.65	
Ferriday	95	53	77.1	1.45	
Franklin	99	60	79.4	4.21	
Grand Cane	101	48	78.1	1.02	
Grand Coteau	96	56	78.9	2.90	
Houma	95	63	77.4	9.19	
Jennings	98	58	78.8	6.23	
La Fayette	97	57	77.8	3.12	
Lake Charles	97	52	78.8	5.40	
Lakeside	97	61	79.7	6.01	
Lawrence	101	65	79.2	15.63	
Libertyhill	101	50	78.2	0.11	
Melville	102	54	79.7	1.53	
Minden	105	50	77.8	1.20	
Monroe	100	52	78.4	2.16	
Newellton	95	51	75.8	0.52	
New Iberia	91e	60e	78.6e	3.00	
Opelousas	99	55	79.4	3.29	
Plain Dealing	102	49	78.4	0.34	
Rayne	99	58	79 2	4.31	
Reserve	101	60	80.4	3.60	
Robeline	100	45	77.0	1.51	
Ruston	97	55	78.6		
St. Francisville	95	57	78.6	3.25	
Schriever	99	59	79.2	5.70	

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Louisiana—Cont'd.	°	°	°	*Ins.*	*Ins.*
Southern University	.....	.....	.....	6.98	
Sugar Experiment Station	94	64	79.1	8.92	
Sugartown	95	51	76.6	4.19	
Tallulah	96	52	76.3	4.17	
Maine.					
Bar Harbor	82	34	58.0	5.90	
Cornish	82	32	58.0	7.51	
Danforth	.....	.....	.....	4.13	
Debsconeag	85	33	57.0	6.10	
Fairfield	81	36	58.4	5.23	
Farmington	83	32	57.4	5.97	
Gardiner	84	36	59.8	7.38	
Greenville	80	29	57.5	5.64	
Houlton	79	28	53.4	5.00	
Lewiston	86	39	60.2	7.03	
Madison	83	35	57.8	7.49	
Mayfield	77	34	55.0	5.67	
Millinocket	80	30	58.2	5.31	
North Bridgton	85	34	59.0	6.49	
Oquossoc	.....	.....	.....	7.25	
Orono	81	37	59.4	6.12	
Patten	79	27	55.6	6.04	
Rumford Falls	84	32	58.2	6.34	
The Forks	.....	.....	.....	5.75	
Van Buren	84	23	54.5	3.70	
Winslow	84	29	58.2	6.00	
Maryland.					
Annapolis	90	45	70.0	10.95	
Cambridge	95	43	74.0	5.25	
Cheltenham	89	38	68.6	7.59	
Chestertown	85	43	68.6	6.77	
Chewsville	88	36	66.2	5.92	
Clear Spring	86	39	64.9	4.10	
Coleman	90	44	70.1	7.93	
College Park (Md. Ex. Sta.)	91	37	68.4	8.06	
Cumberland	.....	.....	.....	3.43	
Darlington	86	39	65.6	7.96	
Deer Park	83	30	61.3	3.72	
Denton	92	39	70.0	7.18	
Easton	89	45	69.7	7.43	
Fallston	90	39	67.4	8.90	
Frederick	90	40	68.0	5.04	
Frostburg	.....	.....	.....	5.08	
Grantsville	80	35	61.6	3.93	
Great Falls	92	38	68.4	7.40	
Greenspring Furnace	89	36	66.1	4.27	
Harney	.....	.....	.....	5.67	
Jewell	90	41	69.2	5.78	
Keedysville	91	38	68.0	5.40	
Lake Montebello	91	42	69.2	9.82	
Laurel	91	39	68.6	5.90	
Monrovia	89	38	67.8	7.17	
Mount St. Marys College	87	41	67.2	7.06	
Oakland	82	31	61.6	3.80	
Ocean City	90	43	66.4	2.46	
Pocomoke City	90	44	71.3	3.15	
Portobello	91	45	72.4	5.18	
Princess Anne	91	40	70.4	3.09	
Salisbury	93[j]	39[j]	70.0[j]	4.46	
Solomons	87	48	72.2	4.47	
Sudlersville	90	40	69.9	6.28	
Takoma Park	90	40	68.4	7.89	
Taneytown	89[d]	38	66.7[d]	5.61	
Towson	.....	.....	.....	7.71	
Van Bibber	86	.....	70.6	9.27	
Western Port	89	36	66.5	5.32	
Woodstock	85	44	68.6	8.40	
Massachusetts.					
Amherst	85	36	62.0	8.74	
Bedford	81	40	61.0	.....	
Bluehill (summit)	84	39	61.9	8.81	
Chestnut Hill	89	40	64.5	10.02	
Concord	86	38	61.2	9.05	
Fall River	85	43	64.9	7.33	
Fitchburg	85	40	61.8	8.90	
Framingham	87	32	61.7	8.32	
Groton	84	35	59.8	10.17	
Holyoke	88	35	62.6	9.83	
Hyannis	80	44	63.6	4.96	
Jefferson	.....	.....	.....	9.61	
Lawrence	87	38	62.0	5.56	
Leominster	.....	.....	.....	10.13	
Lowell	85	38	63.8	8.52	
Middleboro	86	33	63.6	8.51	
Monson	84	35	62.2	9.79	
North Billerica	80	36	58.9	7.50	
Plymouth	80	41	62.6	10.38	
Princeton	.....	.....	.....	9.45	
Provincetown	80	45	63.2	7.63	
Salem	.....	.....	.....	8.16	
Sterling	.....	.....	.....	8.74	
Taunton	84	33	62.9	9.37	
Westboro	88	38	63.8	9.62	
Weston	.....	.....	.....	8.36	
Williamstown	81	36	60.2	6.06	
Winchendon	.....	.....	.....	8.36	
Worcester	86	40	61.6	9.46	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Michigan.	°	°	°	*Ins.*	*Ins.*
Adrian	88	30	64.1	6.28	
Agricultural College	84	33	61.8	4.68	
Allegan	89[e]	32[e]	59.8[e]	.....	
Alma	89	32	60.4	7.39	
Ann Arbor	85	32	62.5	4.19	
Arbela	90	32	62.0	5.28	T.
Ball Mountain	84	32	60.1	4.38	
Battle Creek	90	32	61.7	5.68	
Bay City	94	35	61.6	7.95	
Berlin	85	33	61.7	3.60	
Big Rapids	87	30	58.8	4.71	
Birchwood Beach	92	34	65.5	5.30	
Blaney	74[e]	26[e]	50.8[e]	.....	
Bloomingdale	91	38	62.6	4.70	
Calumet	75	32	52.6	4.75	
Cassopolis	89	34	62.2	4.10	
Charlevoix	89	38	61.0	3.44	
Charlotte	84	30	58.9	4.34	
Chatham	83	24	53.2	5.86	
Cheboygan	83	33	58.0	4.98	
Clinton	86	28	61.3	3.76	
Coldwater	86	30	63.7	6.52	
Concord	83	31	60.8	6.19	
Deer Park	79	33	55.0	2.58	T.
Detour	75	35	56.1	3.55	
Durand	87	32	62.4	3.82	
Eagle Harbor	78	31	52.9	2.93	
East Tawas	79[e]	32[e]	60.0[e]	3.40	
Eloise	86	34	63.8	4.52	
Ewen	80	21	55.2	4.94	
Flint	87	34	61.2	5.40	
Frankfort	78	41	60.2	2.65	
Gaylord	80	34	58.4	3.92	
Grand Marais	71	33	54.0	2.93	
Grape	86	33	63.4	5.33	
Grass Lake	88	30	61.2	6.00	
Grayling	88	34	59.2	6.45	T.
Harbor Beach	95	33	61.8	8.28	
Harrison	91	34	59.2	4.00	
Harrisville	87	32	59.4	3.81	
Hayes	90	37	60.4	4.47	
Highland	.....	.....	.....	4.11	
Hillsdale	.....	.....	.....	5.03	
Holland	87	38	62.8	4.68	
Howell	85	32	61.6	4.44	
Humboldt	76	22	51.8	4.75	
Iron Mountain	85	32	57.2	4.25	
Iron River	81	21	54.8	7.44	T.
Ishpeming	.....	.....	.....	4.80	
Isle Royal	66	35	50.2	3.13	
Ivan	88	30	58.2	4.70	
Jackson	89	33	63.5	6.19	
Jeddo	87	33	61.2	4.17	
Kalamazoo	87	32	61.4	5.38	
Kenton	.....	.....	.....	5.20	T.
Lake City	80	26	56.7	4.53	
Lansing	89	33	62.0	5.18	
Lapeer	87	34	62.2	4.83	
Ludington	79[e]	42[e]	62.7[e]	.....	
Macinac Island	72	34	54.0	9.25	
Mackinaw	84	35	59.6	5.00	
Mancelona	86	33	56.9	3.90	
Maple Ridge	85	25[e]	53.4[e]	4.05	
Menominee	92	32	58.8	7.20	
Montague	81	32	59.4	4.08	
Morenci	87	31	63.2	5.74	
Mount Clemens	76	33	58.2	3.48	
Mount Pleasant	90	30	58.9	3.10	
Muskegon	85	34	60.4	4.14	
Newberry	85	38	60.0	.....	
Old Mission	85	38	58.8	.....	
Olivet	84	34	60.2	7.01	
Omer	85	31	58.5	3.58	
Ovid	87	32	62.7	4.31	
Owosso	88	31	62.0	4.66	
Plymouth	87	38	58.2	.....	
Port Austin	89	38	64.0	1.85	
Powers	83	27	53.6	.....	
Reed City	86	25	59.1	.....	
Roscommon	89	29	57.4	5.54	
Saginaw (W. S.)	90	33	62.4	5.58	
St. Ignace	78	29	51.4	.....	
St. James	80	31	54.4	.....	
St. Johns	92	32	62.0	.....	
St. Joseph	83	47	63.8	4.56	
Saranac	90	29	60.8	6.21	
South Haven	80	41	59.4	3.97	
Stanton	80	36	55.2	5.26	
Thomaston	85	21	54.2	3.16	
Thornville	84	35	61.3	4.08	
Traverse City	85[e]	38[e]	62.3[e]	3.79	
Vassar	83	35	62.8	4.40	
Wasepi	89	33	61.6	5.88	
Webberville	87	30	62.4	4.78	
West Branch	80[e]	38[e]	56.4[e]	.....	
Wetmore	80	20	52.3	4.14	
Whitefish Point	76	35	53.6	4.01	
Woodlawn	85	28	55.9	4.03	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Michigan—Cont'd.	°	°	°	*Ins.*	
Ypsilanti	85	31	62.5	5.76	
Minnesota.					
Albert Lea	87	29	60.4	2.67	
Alexandria	83	25	55.0	1.95	
Angus	79	18	51.4	2.46	
Bagley	75	19	51.4	3.24	
Beardsley	86	21	55.8	1.27	
Beaulieu	76	21	52.6	3.56	
Bird Island	85	27	58.6	3.28	
Blackduck	78	19	52.8	2.42	
Caledonia	82	30	59.0	4.69	
Campbell	.....	.....	.....	1.43	
Cass Lake	.....	.....	.....	3.85	
Collegeville	86	30	57.1	3.04	
Crookston	78	24	51.4	2.71	
Detroit	79	20	51.7	2.71	
Fairmount	83	35	59.6	1.85	
Faribault	82	27	57.0	3.04	
Farmington	81	29	58.4	4.57	
Fergus Falls	82	26	56.0	3.07	
Floodwood	81	21	53.3	7.12	
Fort Ripley	.....	.....	.....	2.26	
Glencoe	91	27	58.9	2.21	
Grand Meadow	84	28	58.4	3.66	
Hallock	78	18	50.8	2.03	
Halstad	77	18	51.8	2.82	
Hinckley	87	23	55.6	4.27	
International Falls	78	23	52.0	1.86	T.
Lake Crystal	84	31	58.8	3.00	
Leech Lake	74	22	52.0	4.69	
Little Falls	81	27	55.6	3.45	T.
Long Prairie	88	18	53.0	1.70	
Luverne	85	29	58.0	1.82	
Lynd	87	22	56.7	1.78	
McIntosh	80	21	51.5	4.38	
Milaca	83	24	55.4	6.12	
Milan	84	21	55.8	1.63	
Minneapolis[n]	85	27	56.5	4.46	
Montevideo	89	25	58.7	1.34	
Mora	82	22	55.4	5.43	
Morris	83	26	56.6	1.69	
Mount Iron	80	23	52.8	3.62	T.
New London	83	30	57.6	2.03	
New Richland	83	30	60.8	2.04	
New Ulm	87	30	.....	3.29	
Osakis	84	25	55.2	1.92	
Park Rapids	77	23	53.0	3.09	T.
Pine River	77	26	54.4	3.57	
Pipestone	85	32	60.4	2.96	
Pokegama Falls	83	21	53.4	3.09	
Red Wing	.....	.....	.....	8.30	
Redwood Falls	88	29	59.8	1.77	
St. Charles	85[d]	27[e]	58.8[d]	4.96	
St. Cloud	88	27	57.6	5.15	
St. Peter	.....	.....	.....	4.73	
Sandy Lake Dam	82	22	54.6	5.47	
Shakopee	87	27	58.6	4.64	
Stephens Mines	79	23	51.5	3.63	T.
Tonka Bay	.....	.....	.....	4.17	
Two Harbors	74	27	54.0	7.03	
Wabasha	87	30	60.6	3.10	
Windom	89	28	59.6	2.80	
Winnebago	89	31	60.1	3.43	
Winnebigoshish	75	27	55.0	3.24	
Winona	88	34	60.0	6.15	
Worthington	86	30	58.6	2.66	
Mississippi.					
Aberdeen	104	46	75.6	2.11	
Agricultural College	101[d]	48[e]	75.4[d]	.....	
Anguilla	92	50	75.0	4.63	
Austin	98[e]	44	73.6[b]	2.06	
Batesville	101	43	75.6	0.81	
Bay St. Louis	94	64	78.3	12.13	
Bellefontaine	.....	44[d]	71.9[f]	1.20	
Biloxi	97	62	79.5	11.18	
Brookhaven	96	55	76.4	3.31	
Canton	94	51	75.2	4.82	
Clarksdale	93	47	73.6	1.79	
Columbia	.....	.....	.....	4.80	
Columbus	100	47	74.8	2.37	
Corinth	94	46	72.0	2.69	
Crystal Springs	94	54	76.2	4.20	
Duck Hill	100	45	74.4	2.28	
Edwards	94	53	76.4	2.33	
Enterprise	.....	.....	.....	2.61	
Fayette	90	51	74.4	2.56	
Fayette (near)	.....	.....	.....	1.23	
Greenville	95	52	74.6	4.40	
Greenwood	97	49	74.4	2.60	
Hattiesburg	99	55	77.8	8.48	
Hazlehurst	94	54	76.3	3.72	
Hernando	100	47	74.6	1.33	
Holly Springs	96	48	73.7	1.16	
Indianola	97	46	73.2	2.17	
Jackson	93	52	74.9	4.27	
Kosciusko	97	47	75.0	2.44	
Lake	96[b]	47[i]	75.0[g]	2.66	
Lake Como	99	48	75.6	2.32	

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Mississippi—Cont'd.	°	°	°	*Ins.*	*Ins.*
Leakesville	100	56	78.0	12.74	
Louisville	96	49	75.2	1.69	
McNeill	96	60	78.0	6.06	
Macon	100	48	74.3	2.60	
Magnolia	97	56	77.2	6.42	
Monticello	98	52	76.6	3.48	
Natchez	96	52	78.4	2.95	
Okolona	101	47	74.8	3.89	
Pearlington	99	61	78.0	6.30	
Pecan	99	60	78.4	8.40	
Pittsboro	99	47	74.1	4.98	
Pontotoc	96	50	73.6	1.48	
Porterville	102	47	72.2	2.14	
Port Gibson	96	49	75.8	1.38	
Quitman	99	50	76.2	2.54	
Ripley	98	40	73.0	2.45	
Shoccoe	95	51	75.0	4.91	
Shubuta	.....	.....	.....	4.25	
Suffolk	95	58	77.0	2.95	
Swan Lake	.....	.....	.....	2.91	
Tchula	92	47	73.2	3.71	
Tupelo	100	46	74.4	1.73	
University	99	40	75.1	0.81	
Utica	95	58	75.5	1.76	
Water Valley	99	47	75.6	1.20	
Waynesboro	98	51	75.6	3.55	
Woodville	94	55	76.7	4.33	
Yazoo City	94	51	74.9	4.22	
Missouri.					
Appleton City	100	41	70.8	1.24	
Arthur	100	39	70.5	1.51	
Avalon	96	39	68.8	3.70	
Belle	96[f]	36[f]	69.8[f]	.....	
Bethany	92	36	65.4	2.01	
Birch Tree	96	41	68.7	1.59	
Bolivar	96	36	69.6	1.30	
Booneville	.....	.....	.....	1.42	
Brunswick	96	39	67.7	2.82	
Caruthersville	99	47	72.8	1.39	
Clinton	96	42	70.0	0.77	
Conception	91	38	64.8	3.03	
Darksville	91	36	66.9	1.83	
Dean	100	45	71.9	2.16	
Doniphan	95	43	69.1	1.51	
Eldorado Springs	101	39	70.3	1.27	
Fairport	.....	.....	.....	2.93	
Fayette	93	37	66.0	1.87	
Fulton	94	39	68.4	1.99	
Gallatin	.....	.....	.....	3.42	
Gano	94	42	69.3	3.01	
Goodland	94	39	65.9	3.68	
Gorin	.....	.....	.....	1.70	
Grant City	93	38	66.0	3.17	
Harrisonville	96	43	68.6	1.59	
Hazlehurst	.....	.....	.....	1.66	
Hermann	.....	.....	.....	2.03	
Houston	97	38	68.3	2.50	
Huntsville	.....	.....	.....	4.03	
Ironton	98	37	67.2	2.38	
Jackson	98	40	70.9	1.88	
Jefferson City	96	37	68.0	1.86	
Kidder	96	37	67.7	3.92	
Koshkonong	98	44	70.2	3.91	
Lamar	98	42	70.6	1.83	
Lamonte	.....	.....	.....	0.82	
Lebanon	94	38	68.6	1.89	
Lexington	95	38	68.3	2.26	
Liberty	94	41	68.0	1.86	
Lockwood	95	45	71.2	1.72	
Louisiana	94	33	65.9	0.96	
Marble Hill	97	40	68.8	3.47	
Marshall	94[e]	38[e]	67.3[e]	1.69	
Maryville	95	36	65.5	3.34	
Mexico	94	35	66.9	1.26	
Monroe	92	33	67.9	1.12	
Mountain Grove	93	41	68.2	3.22	
Mount Vernon	97	41	70.6	2.21	
Neosho	96	40	70.5	2.25	
Nevada	.....	.....	.....	1.67	
New Madrid	.....	.....	.....	1.43	
New Palestine	95	38	69.6	0.95	
Oakfield	93	39	68.8	1.40	
Olden	95	36	69.2	1.21	
Oregon	93	41	66.8	3.90	
Osceola	.....	.....	.....	0.73	
Princeton	98	33	66.9	2.03	
Rolla	92	41	67.9	2.26	
St. Charles	94	44	68.6	0.97	
St. Joseph	.....	.....	.....	2.80	
Sikeston	96	41	70.2	1.58	
Steffenville	93	36	67.0	1.90	
Sublett	91	31	65.1	3.26	
Trenton	90	39	67.0	2.33	
Unionville	91	34	65.0	2.16	
Versailles	98	39	68.8	0.70	
Warrensburg	94[j]	46[j]	70.4[j]	.....	
Warrenton	93	37	67.0	1.48	
Warsaw	97	37	69.8	1.51	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Missouri—Cont'd.	°	°	°	*Ins.*	*Ins.*
Wheatland	.....	.....	.....	2.20	
Willow Springs	95	36	69.2	2.49	
Montana.					
Absarokee	.....	.....	.....	2.71	T.
Adel	80	24	50.6	0.71	
Anaconda	82	29	52.9	1.37	
Augusta	80	22	49.6	0.91	
Babb	74[b]	18[b]	45.1[b]	3.37	24.0
Billings	97	25	59.0	0.68	
Bozeman (Agr. College)	79	29	52.6	0.41	
Bowen	83	15	47.4	1.29	
Broadview	86	26	55.2	0.46	
Busby	90	25	55.2	2.03	
Butte	81	24	54.8	1.50	
Canyon Ferry	80	31	55.4	0.63	
Cascade	83	26	54.8	1.11	
Chester	80	26	50.8	0.93	
Choteau	84	25	51.5	0.66	
Columbia Falls	83	28	53.0	2.08	T.
Copper	.....	.....	.....	1.07	1.0
Crow Agency	82	30	57.0	1.20	
Culbertson	85	26	53.6	0.15	
Dayton	88	31	55.4	1.30	
Decker	80	27	52.8	3.30	
Dillon	81	28	55.2	1.01	
East Anaconda	79	32	52.4	1.32	
Ekalaka	94	25	56.8	1.42	
Ericson	.....	.....	.....	1.51	
Fallon	91	14	55.8	T.	
Fort Benton	85	30	54.5	1.05	
Fort Harrison	81	31	53.5	.....	
Fort Shaw	81	24	54.1	0.27	
Fortine	78	27	49.8	2.54	T.
Glasgow	85	15	53.8	0.46	
Glendive	89	16	58.1	T.	
Gold Butte	74	12	44.7	3.23	15.5
Graham	90[i]	28[i]	56.0[i]	2.59	T.
Great Falls	79	29	54.2	0.25	
Hamilton	.....	.....	.....	1.07	
Highwood	.....	.....	.....	0.80	
Home Park	.....	.....	.....	0.40	
Huntley	90	34	58.2	0.93	
Lake McDonell	82[b]	30[b]	52.2[b]	2.19	
Lewistown	87	28	53.2	0.75	T.
Livingston	86	31	57.2	1.44	2.0
Lodge Grass	85	32	56.0	2.20	
Missoula	.....	.....	.....	1.04	
Moore	.....	.....	.....	0.55	T.
Norris	84	34	57.4	0.38	
Nye	.....	.....	.....	2.77	4.0
Ovando	80	20	54.0	0.85	
Philipsburg	80	23	51.0	1.15	
Plains	83	31	54.5	1.18	
Pleasant Valley	82	27	50.4	2.94	
Poplar	87	13	55.0	T.	
Red Lodge	78	26	51.7	2.94	5.0
Renovo	84	26	54.7	1.52	
Saltese	.....	.....	.....	2.40	
Snowshoe	75	29	49.2	3.24	9.0
Steele	84	30	54.8	0.71	
Tokna	87	15	56.4	0.25	
Tosten	85	28	54.4	0.69	
Troy	80	33	54.5	2.33	
Utica	85	32	52.8	0.73	
Valentine	88	16	55.6	0.08	
Wolf Creek	89	29	54.6	0.40	
Nebraska.					
Ainsworth	93[a]	30[a]	59.5[a]	2.80	
Albion	92[a]	32[a]	61.6[a]	2.65	
Alliance	90	30	62.2	0.50	T.
Alma	96	33	66.2	1.71	
Anoka	93	28	59.8	3.34	
Arapahoe	.....	.....	.....	0.65	
Arcadia	.....	.....	.....	2.65	
Ashland	95	37	66.4	3.03	
Ashton	.....	.....	.....	2.62	
Atkinson	91	31	60.0	1.65	
Auburn	96	35	65.2	4.33	
Aurora	96	31	69.1	4.70	
Beatrice	94	37	66.8	5.67	
Beaver	100	37	68.0	1.10	
Bellevue	93	42	66.2	1.98	
Benkleman	.....	.....	.....	0.69	
Blair	92	35	64.8	2.66	
Bloomfield	89	31	61.0	3.04	
Blue Hill	.....	.....	.....	3.98	
Bradshaw	.....	.....	.....	2.47	
Bridgeport	92	32	60.3	0.98	
Broken Bow	94	31	62.1	0.94	
Burchard	.....	.....	.....	6.93	
Burwell	.....	.....	.....	0.40	
Cambridge	101	33	67.4	1.19	
Central City	.....	.....	.....	3.51	
Columbus	94	34	63.2	1.72	
Crete	94	38	66.6	4.60	
Culbertson	99	25	64.6	1.01	
Curtis	90	32	61.4	3.07	
David City	91	36	64.8	4.04	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Nebraska—Cont'd.	°	°	°	*Ins.*	*Ins.*
Dawson	98	38	68.0	4.63	
Du Bois	.....	.....	.....	4.08	
Duff	.....	.....	.....	2.85	
Edgar	.....	.....	.....	4.07	
Ellis	.....	.....	.....	5.22	
Ericson	.....	.....	.....	2.65	
Ewing	89	29	58.9	1.79	
Fairbury	97	37	68.2	6.41	
Fairmont	96	33	65.5	2.29	
Fort Robinson	90	27	56.6	1.90	
Franklin	98[d]	36[d]	69.2[d]	2.46	
Fremont	94	34	64.8	2.52	
Fullerton	94	34	64.7	3.58	
Geneva	97	36	67.4	3.63	
Genoa (near)	95	35	64.8	3.58	
Gering	.....	.....	.....	1.23	
Gosper	.....	.....	.....	2.22	
Gothenburg	98	34	65.0	2.02	
Grand Island	96	36	66.2	2.87	
Grant	95	30	61.2	1.66	
Greeley	93	31	63.0	1.70	
Guide Rock	.....	.....	.....	3.61	
Haigler	.....	.....	.....	1.50	
Halsey	96	32	63.6	1.69	
Hartington	92	32	60.4	1.60	
Harvard	95	35	64.2	3.58	
Hastings	95	38	66.0	2.13	
Hayes Center	94	35	64.4	1.63	
Hay Springs	91	29	58.1	1.05	T.
Hebron	95	37	66.6	7.19	
Hendley	.....	.....	.....	1.17	
Holdrege	98	36	68.6	2.47	
Hooper	92	36	62.2	2.53	
Imperial	93	34	62.9	1.97	T.
Kearney	96	33	64.6	2.10	
Kimball	87	31	59.7	1.13	
Kirkwood	97	31	57.0	3.48	
Leavitt	100	32	64.0	3.45	
Lexington	95	36	64.8	2.35	
Lodgepole	88[d]	32[d]	58.4[d]	1.15	
Loup	95	33	63.5	2.00	
Lynch	96	28	62.2	2.25	
McCook	.....	.....	.....	1.18	
McCool	.....	.....	.....	5.89	
Madison	92	34	62.3	3.05	
Marquette	.....	.....	.....	4.00	
Mason	.....	.....	.....	3.02	
Minden	100	34	66.2	2.31	
Monroe	.....	.....	.....	3.96	
Nebraska City	93	35	66.9	3.14	
Nemaha	.....	.....	.....	3.25	
Norfolk	94	32	62.1	3.79	
North Loup	96	33	63.0	1.83	
Oakdale	93	31	60.4	1.72	
Oakland	96	34	63.6	2.14	
Odell	.....	.....	.....	3.07	
Ord	.....	.....	.....	2.75	
Osceola	.....	.....	.....	4.00	
Palmyra	94	38	65.4	3.55	
Pawnee City	97	35	65.9	4.19	
Plymouth	95	36	67.6	5.41	
Purdum	93	32	61.9	1.17	
Ravenna	95	35	64.4	2.82	
Redcloud	97	35	70.7	.....	
Republican	.....	.....	.....	1.05	
St. Libory	.....	.....	.....	3.44	
St. Paul	96	35	65.7	3.32	
Santee	95	37	65.0	3.60	
Schuyler	.....	.....	.....	1.57	
Scottsbluff	92	30	60.0	1.04	T.
Seward	93	34	67.6	5.34	
Springview	90	32	59.6	2.17	
Stanton	94	32	62.6	3.52	
Strang	.....	.....	.....	7.26	
Stratton	.....	.....	.....	1.29	
Superior	96	37	66.6	4.57	
Syracuse	.....	.....	.....	7.80	
Table Rock	.....	.....	.....	4.12	
Tecumseh	96	34	67.2	4.21	
Tekamah	92	34	64.0	1.75	
Turlington	94	39	65.8	6.00	
University Farm	93	34	66.2	3.40	
Wahoo	.....	.....	.....	4.10	
Wakefield	93	31	61.7	2.60	
Watertown	.....	.....	.....	2.15	
Wauneta	.....	.....	.....	2.16	
Weeping Water	96	31	65.2	3.66	
Westpoint	93	31	63.4	2.94	
Wilber	.....	.....	.....	5.40	
Wilsonville	.....	.....	.....	1.33	
Wisner	.....	.....	.....	4.38	
Wymore	99	42	70.7	4.59	
York	95	38	68.1	4.17	
Nevada.					
Amos	94	22	57.4	0.29	
Austin	83	31	57.9	0.91	3.0
Battle Mountain	84	38	60.4	1.50	
Carlin	79	45	62.4	T.	

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Nevada—Cont'd.	°	°	°	*Ins.*	*Ins.*
Carson Dam	92	34	62.3	T.	
Clover Valley	86	27	56.0	0.88	T.
Columbia	91	31	61.6	T.	
Elko [1]	80	38	58.3	0.37	
Eureka	88	28	58.4	0.64	0.2
Fallon	95	29	60.1	0.12	
Fenelon [1]				0.95	7.0
Fernley	93	34	63.4	0.27	
Geyser	89	18	52.6	0.00	
Golconda	90	28	60.4	0.55	
Halleck [1]	85	27	56.2		
Humboldt [1]	88	40	60.7	0.40	
Jean	101	52	81.6	0.05	
Las Vegas	107	38	74.8	T.	
Leetville	96	30	61.4	T.	
Lewers Ranch	92	30	57.2	T.	
Logan	108	43	75.6	0.38	
McAfees Ranch	90	12	51.4	T.	
Mill City [1]	90	32	60.3	0.12	
Millett	88	22	56.4	0.07	
Palmetto	88	21	54.6	0.31	T.
Potts	85	18	51.2	0.15	3.0
San Jacinto	83	23	54.2	0.92	
Soda Lake	95	26	62.4	0.33	
Squaw Valley	92	17	55.8	0.80	T.
Tecoma	89	23	56.0	0.52	
Wabuska	90	26	57.9	0.02	
Wells [1]	91	38	63.8	0.00	
New Hampshire.					
Alstead	80	35	57.8	8.33	
Brookline	86	36	61.1	8.78	
Durham	84	33	60.7	8.40	
Franklin Falls	86	33	59.8	8.85	
Grafton	85	30	57.4	6.48	
Hanover	86	35	59.2	6.26	
Keene	86	30	60.4	7.73	
Nashua	87	36	61.6	8.42	
Newton	84	29	59.4	7.85	
Plymouth	85	32	59.0	7.14	
New Jersey.					
Asbury Park	87	42	67.4	6.97	
Bayonne	89	43	67.6	7.44	
Belvidere	87	38	65.5	8.42	
Bergen Point	89	44	67.8	8.02	
Beverly	88	40	67.8	5.94	
Bridgeton	90	40	69.9	8.36	
Browns Mills	91	36	68.4	8.76	
Burlington				6.89	
Canton				7.65	
Cape May C. H.	86	43	69.0	3.85	
Charlotteburg	82	31	63.4	12.54	
Clayton	89	40	68.2	7.62	
College Farm	88	37	66.8	6.85	
Culvers Lake				10.67	
Dover	85	34	63.7	10.38	
Elizabeth	87	42	67.8	6.18	
Englewood	86	43	67.0	8.40	
Flemington	89	39	67.4	11.24	
Friesburg	91	39	68.4	6.40	
Hightstown	87	39	67.2	6.48	
Imlaystown	90	39	67.4	7.29	
Indian Mills	92	37	68.2	10.51	
Jersey City	88	45	68.6	7.37	
Lambertville	88	40	67.2	7.84	
Layton	85	32	62.8	8.14	
Moorestown	88	39	67.4	6.74	
Newark	89	42	67.4	10.17	
New Brunswick	87	40	67.0	6.64	
Oceanic	86	42	67.2	8.48	
Paterson	88	40	67.3	10.33	
Phillipsburg	89	38	66.6	8.51	
Plainfield	88	38	66.6	7.44	
Pleasantville				4.19	
Rancocas				7.19	
Rivervale	88	31	64.0	8.06	
Runyon				7.02	
Somerville	90	38	67.4	7.88	
South Orange	84	41	65.6	8.92	
Sussex	88	39	64.8	9.51	
Toms River	90	35	66.8	9.17	
Trenton	86	42	67.4	6.81	
Tuckerton	88	38	67.6	6.34	
Vineland	92	39	68.8	8.69	
New Mexico.					
Alamogordo	92	50	72.8	1.74	
Albert	93	43	70.8	0.68	
Albuquerque	95[f]	46[b]	68.6[b]	0.20	
Alto				3.51	
Bellranch	94	40	71.2	0.17	
Bloomfield	90	32	63.8	0.21	
Carlsbad	96	46	73.6	T	
Chama	78	23	54.7	2.44	5.0
Cimarron	84	33	60.7	0.04	
Clayton	92	40	70.9	1.85	
Cliff	95	31	70.0	1.73	
Cloudcroft	71	32	53.6	1.44	
Datil	82[e]	38[e]	61.8[e]	1.20	
Deming	104	56	81.8	2.40	
New Mexico—Cont'd.					
Dorsey	84	37	62.6	0.07	
Dulce	86	25	57.8	2.23	
Eagle Rock Ranch	80	33	60.2	0.53	
Elizabethtown	73	21	50.6	0.01	0.1
Elk	87	42	64.4	0.78	
Fort Bayard	86	40	67.0	1.69	
Fort Stanton	85	33	62.7	1.85	
Fort Union	81	28	58.8	0.82	
Fort Wingate	82	34	60.7	0.30	
Frisco	90[d]	46[d]	68.7[d]	1.43	
Fruitland	86[f]	30[f]	63.2[f]	0.20	
Gage	95	54	73.8	1.31	
Glen	94	41	70.4	0.46	
Hillsboro	86	40	69.0	1.37	
Hope				0.00	
Laguna	87	38	62.8	T.	
Lake Valley				1.93	
Las Vegas	87	31	62.2	0.22	
Logan	93	39	71.8	0.55	
Lordsburg	97	38	74.8	T.	
Los Alamos				0.09	
Los Lunas	88	36	65.0	1.35	
Magdalena	85	36	62.3	1.16	
Manuelito				0.51	
Mesilla Park	95	44	74.1	1.16	
Mimbre's				2.66	
Mineral Hill				0.73	
Monument	93	50	74.6	0.92	
Mountain Air	86	38	63.6	1.99	
Nara Visa	91	42	69.8	0.42	
Nursery Site	80	30	57.7	0.73	
Orange	94	43	70.6	0.34	
Redrock				0.38	
Rincon	92	37	72.0	2.58	
Rociada	80	22	55.4	0.47	
Rosa				0.44	
Rosedale	78	35	61.0	2.15	
San Jon	91	43	71.3	0.08	
San Marcial [b]	86	50	68.8		
San Rafael	86	33	62.0	0.51	
Socorro	93	33	67.1	2.47	
Springer	88	32	62.1	0.60	
Strauss				0.50	
Taos	80	30	58.4	0.55	T.
Tres Piedras	78	27	54.0	0.72	
Tucumcari	93[j]	46[j]	72.8[j]	0.08	
Valley				1.64	
Vermejo	82	29	56.0	0.18	
Winsor	75	22	50.2	0.51	
New York.					
Adams	84	40	61.9	5.15	T.
Addison	89	34	63.6	5.73	
Allegany	86	33	62.8	2.68	
Amsterdam	87	35	61.2	5.54	
Angelica	83	32	60.2	4.17	
Appleton	91	44	63.2	2.96	
Athens	85	39	64.4	11.14	
Auburn	87	42	62.8	3.62	
Avon	85	40	63.0	3.05	
Baldwinsville	86	41	62.6	3.53	
Ballston Lake	76	36	60.8	6.70	
Bedford	85	37	64.6	12.50	
Blue Mountain Lake				10.35	
Bouckville	83	34	59.3	6.72	
Brockport	87	43	63.2	4.21	
Cape Vincent	80	42	61.8	6.55	
Carmel	83	38	64.0	10.27	
Carvers Falls	82	37	60.0	8.11	
Chatham	89	36	64.2	7.62	
Chazy	85	37	60.0	6.50	
Cooperstown	80	38	59.4	8.07	
Cortland	83	39	63.0	4.41	
Cutchogue	88	45	67.0	4.71	
Dannemora	84	32	58.4	6.93	
De Ruyter	86	36	59.8	6.85	
Easton				11.22	
Elba	89	40	61.4	3.49	
Elmira	87	37	63.9	4.50	
Fayetteville	88	38	63.0	3.89	
Fort Plain	86	37	64.4	6.28	
Franklinville	83	33	59.8	4.63	T.
Glens Falls	85	37	61.3	7.61	
Gloversville	84	33	59.3	6.68	
Greenfield	85	36	60.2	8.62	
Greenwich	81[c]	34[c]	61.1[c]	8.19	
Griffin Corners	83	28	58.6	7.24	
Harkness	83	36	59.1	6.48	
Haskinville				5.05	
Hemlock	82	41	62.4	3.67	
Hunt	85	36	64.4	4.52	
Indian Lake	84	35	57.4	7.33	
Ithaca	86	42	63.2	3.96	
Jamestown	85	40	63.4	5.84	
Jeffersonville	85	30	61.4	5.80	
Keene Valley	86	36	58.1	6.29	
Kings Ferry				4.02	
Lake George	83	38	60.0	7.75	
Le Roy	84	42	61.8	4.22	
New York—Cont'd.					
Liberty	81	35	55.8	7.84	
Little Falls City Res.	83	37	59.9	6.05	
Lockport	85	40	62.2	3.45	
Lowville	81	38	59.2	4.57	
Lyndonville				3.44	
Lyons	89	40	64.2	3.41	
Middletown	82	42	64.8	8.42	
Mohonk Lake	79	38	60.8	9.01	
Moira	83	35	60.0	5.15	
Newark Valley				6.42	
New Lisbon	82	30	58.4	8.10	
North Hammond	82	38	61.3	4.28	
North Lake	80	32	57.1	7.46	
Norwich	83	36	62.0	8.61	
Ogdensburg	90	39	65.4	3.92	
Oneonta	87	36	62.9	8.28	
Oxford	80	37	61.5	6.55	
Oyster Bay				8.51	
Palermo				1.40	
Penn Yan	90	39	63.9	2.83	
Perry City	84	34	60.2	4.46	
Philadelphia	82	32	61.4	4.35	
Plattsburg	86	34	60.5	6.95	
Port Jervis	84	38	64.5	7.01	
Romulus	87	43	64.0	1.50	
Rose	88	41	62.9	3.12	
Salisbury Mills	86	38	65.1	9.10	
Saranac Lake	79	34	57.0	6.60	
Scarsdale	85	38	62.2	2.91	
Setauket	84	45	66.4	7.31	
Shortsville	88	42	63.4	3.40	
Skaneateles				4.18	
Southampton	81	41	65.7	3.64	
South Canisteo	86	34	61.3	4.16	
Spier Falls	86	36	60.6	7.61	
Taberg	86	40	61.8	7.16	
Ticonderoga	81	41	60.3	7.01	
Volusia	83	41	61.5	4.30	
Wading River	87	35	64.8	5.53	
Wappinger Falls	83	40	65.4	8.20	
Warwick				7.27	
Watertown	84	37	61.8	4.47	
Waverly	88	32	63.6	4.44	
Wedgwood	86	38	62.1	4.49	
West Berne	88	33	61.6	5.86	
West Point	80	41	63.6	10.68	
Windham	83	31	60.4	7.12	
North Carolina.					
Banners Elk	80	32	63.4	5.32	
Beaufort	88	64	78.8	5.25	
Brevard	88	40	67.5	5.31	
Brewers	94	41	70.3	9.23	
Buck Spring	81	35	57.2	9.25	
Caroleen	92	50	71.9	6.74	
Chalybeate Springs	92	48	73.6	5.74	
Chapel Hill	92[b]	47[i]	72.4[i]		
Clinton	92	56	77.2	2.88	
Eagletown	92	44	74.6	2.43	
Edenton	94[c]	47[c]	74.1[c]	2.00	
Fayetteville	90	53	73.3	4.64	
Goldsboro	96	50	76.2	2.85	
Graham				4.68	
Greensboro	94	46	74.0	3.22	
Greenville				4.98	
Henderson	91	47	72.6	4.67	
Hendersonville	87	42	67.0	5.53	
Horse Cove	83	43	67.1	6.72	
Hot Springs	93	45	71.6	5.32	
Kinston	97	51	77.0	3.83	
Lenoir	95	41	71.1	5.48	
Lexington	96	48	73.8	3.44	
Lincolnton	82	46	65.6	3.32	
Louisburg	90	45	75.2	3.47	
Lumberton	96	55	76.4	6.17	
Marion	91	44	70.6	9.22	
Moncure	93	46	73.4	7.32	
Monroe	95	46	72.4	3.94	
Morganton	92	43	70.1	4.64	
Mount Airy	95	41	70.2	6.90	
Mount Holly				4.78	
Murphy				7.09	
Nashville	94	44	74.4	3.06	
New Bern	94	55	76.4	6.42	
Patterson	87	42	66.6	7.12	
Pinehurst	94	50	75.0	5.12	
Ramseur	93	42	73.0	6.38	
Randleman				5.58	
Reidsville	96	45	73.2	6.19	
Rockingham	95	54	76.5	6.93	
Salem	94	43	72.3	3.45	
Salisbury	95	44	73.2	4.31	
Sapphire	83	39	64.1	9.09	
Saxon	94	40	69.8	2.15	
Scotland Neck	92	46	74.8	3.96	
Selma	93	48	75.4	3.82	
Settle	95	40	70.6	4.57	
Sloan	93	55	75.6	4.95	
Snow Hill	92	49	75.0	4.32	

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
North Carolina—Cont'd.	°	°	°	*Ins.*	*Ins.*
Southern Pines	94	48	75.0	4.34	
Southport	94	60	78.9	9.10	
Stateville	91	45	72.1	6.05	
Tarboro	95	46	75.8	3.27	
Vade Mecum	91[e]	36[e]	67.6[e]	.....	
Waynesville	82	40	63.5	5.90	
Weldon	98	43	75.9	2.07	
North Dakota.					
Amenia	84	20	54.0	2.34	
Beach	84	11	52.5	0.59	
Bottineau	80	20	49.3	1.08	T.
Buford	84	15	53.8	0.28	
Cando	78	10	49.8	1.04	
Coal Harbor	80	18	52.5	0.60	
Crosby	80	15	49.6	0.52	T.
Dickinson	84	16	52.9	1.11	
Donnybrook	79	14	49.9	1.06	
Dunseith	78	21	50.2	1.07	
Edgeley	86	19	53.2	2.47	
Edmore	80	16	52.0	0.90	
Ellendale	89	24	58.4	0.85	
Flasher	96	11	87.8	1.50	
Forman	81	22	54.0	1.57	
Fort Berthold	84	15	53.4	0.69	
Fort Yates	85	20	55.2	1.17	
Fullerton	81	19	52.6	2.97	
Gladys	85	12	51.3	0.64	
Glenullen	86[e]	16[e]	51.6[e]	2.02	
Goforth	86	16	52.6	0.74	
Granville	81	16	50.2	1.00	
Hannah	76	15	48.6	1.16	
Hendley	88	19	54.8	0.72	
Hillsboro	79	21	53.8	2.56	
Jamestown	85	17	52.6	2.25	
Kulm	83	19	54.4	3.16	
Lakota	79	18	51.2	1.28	
Langdon	73	19	48.4	1.36	
Lisbon	85	17	52.4	2.72	
McKinney	82	10	49.7	0.88	
Manfred	81	19	50.9	1.45	
Medina	.....	.....	.....	0.70	
Medora	89	16	53.4	0.89	
Melville	83[f]	18[f]	51.1[f]	1.09	
Minot	81	19	50.4	0.98	
Minto	84	21	52.0	3.10	
Mott	84	15	53.4	1.08	
Napoleon	36	10	50.6	0.94	
New England	82	16	51.8	1.00	
New Salem	84	19	52.4	1.47	
Oakdale	82	18	52.7	1.48	
Oriska	79	22	53.7	1.53	
Page	82	20	52.4	.....	
Park River	78	22	52.5	1.38	
Pembina	84	20	51.6	1.30	
Plaza	78	14	50.2	1.02	
Portal	80[d]	9[a]	48.4[c]	0.37	
Power	85	18	53.4	2.67	
Pratt	81	14	50.5	1.30	
Steele	87	19	52.8	1.10	
Towner	80	17	51.4	1.11	
University	79	21	53.0	3.87	
Valley City	81	17	52.6	1.58	
Westhope	82	17	49.8	0.57	
Willow City	80	15	52.6	0.80	
Wishek	85	17	53.0	1.38	
Ohio.					
Akron	87	38	65.1	3.58	
Amesville	90	35	67.7	3.86	
Bangorville	88	34	64.4	4.33	
Bellefontaine	87	33	64.0	2.91	
Benton Ridge	89	32	65.2	4.26	
Bladensburg	87	33	64.8	3.69	
Bowling Green	88	31	64.6	5.70	
Bucyrus	89	32	63.9	5.97	
Cadiz	86	35	65.8	4.32	
Cambridge	88	34	65.6	2.81	
Camp Dennison	93	37	68.6	1.16	
Canal Dover	85	32	63.7	3.07	
Canton	84	35	63.9	2.56	
Cardington	86	31	63.0	2.58	
Circleville	88	37	66.8	4.21	
Clarington	88	38	67.0	5.95	
Clarksville	88	39	67.9	4.34	
Cleveland	87	44	64.6	3.74	
Coalton	92	48	68.0	1.49	
Dayton	89	36	67.2	4.22	
Defiance	91	30	63.6	6.35	
Delaware	90	32	66.0	3.56	
Demos	84	39	66.4	4.95	
Findlay	90	35	66.1	4.63	
Frankfort	88	35	67.3	3.52	
Fremont	88	35	65.6	4.08	
Garrettsville	87	39	63.9	4.42	
Granville	88	34	65.1	6.48	
Gratiot	84	34	64.4	4.61	
Green	89	42	68.9	2.93	
Greenhill	85	32	62.5	4.01	
Greenville	85	37	64.9	2.84	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Ohio—Cont'd.	°	°	°	*Ins.*	*Ins.*
Hedges	89	29	64.1	3.07	
Hillhouse	86	43	63.8	6.37	
Hiram	86	41	63.5	4.23	
Hudson	90	37	64.3	3.26	
Ironton	92	38	69.8	3.47	
Jacksonburg	90	39	67.8	5.72	
Kenton	88	33	64.2	2.89	
Killbuck	87	33	64.6	1.72	
Lancaster	86	36	65.8	3.46	
Lima	85	34	65.8	3.99	
McConnelsville	87	36	66.4	5.61	
Marietta	85	40	68.0	3.93	
Marion	90	32	65.8	3.15	
Medina	89	35	64.9	3.55	
Milfordton	88	30	63.8	2.62	
Milligan	89	31	65.4	3.82	
Millport	85	33	64.0	3.23	
Montpelier	87	32	63.0	6.80	
Napoleon	88	32	64.7	5.55	
Nellie	86	35	63.1	2.35	
New Alexandria	89	35	65.6	5.70	
New Berlin	87	33	63.7	2.20	
New Bremen	90	33	66.3	3.42	
New Richmond	90	39	69.1	1.37	
New Waterford	86	35	64.2	3.77	
North Lewisburg	90	35	67.0	2.45	
North Royalton	88	40	64.8	3.43	
Norwalk	89	32	64.6	4.93	
Oberlin	90	34	65.8	3.94	
Ohio State University	88	35	66.6	3.23	
Ottawa	89	31	64.8	3.46	
Pataskala	87	35	65.2	5.96	
Philo	87	36	66.9	5.61	
Plattsburg	87	35	67.1	2.29	
Pomeroy	91	38	67.2	2.89	
Portsmouth	88	39	67.8	1.77	
Pulse	.....	.....	.....	2.21	
Rittman	.....	.....	.....	2.93	
Rockyridge	90	35	65.2	4.62	
Rome	91	38	64.1	3.12	
Shenandoah	87	33	63.2	4.47	
Sidney	91	35	66.6	5.41	
Somerset	88	38	66.4	4.87	
South Lorain	89	40	64.9	4.57	
Springfield	.....	.....	.....	3.45	
Summerfield	87	34	65.4	4.27	
Thurman	89	42	68.9	2.62	
Tiffin	85	37	64.8	5.32	
Toledo (St. Johns College)	87	38	64.8	4.54	
Upper Sandusky	86	32	65.1	3.98	
Urbana	89	34	65.2	4.33	
Vickery	90	32	63.2	4.43	
Warren	90	41	64.9	3.29	
Wauseon	90	30	63.3	4.67	
Waverly	92	36	68.8	2.32	
Waynesville	85	38	66.4	3.22	
Wellington	89	37	65.6	3.67	
Willoughby	.....	.....	.....	6.80	
Wilson	91	35	68.1	2.32	
Wooster	88	34	65.0	3.13	
Zanesville	.....	.....	.....	4.40	
Oklahoma.					
Alva	101	42	73.9	0.46	
Arapaho	105	42	74.6	1.10	
Buffalo	101	40	74.7	3.99	
Cache	.....	.....	.....	0.95	
Chandler	108	47	77.7	0.80	
Chattanooga	103	45	76.8	1.82	
Cloud Chief	106	42	76.8	1.40	
Dacoma	101	41	73.1	0.90	
Eldorado	105	45	76.4	1.20	
Enid	105[d]	42[e]	74.8[d]	1.31	
Erick	101	42	73.8	1.84	
Fort Sill	102	58	80.4	1.78	
Frederick	.....	.....	.....	0.87	
Gage	100	39	71.2	0.96	
Grand	97[f]	42[f]	71.8[f]	.....	
Guthrie	104	46	75.8	1.56	
Harrington	98	39	71.0	3.97	
Helena	99	48	74.2	.....	
Hennessey	105	46	75.0	0.60	
Hobart	100	47	75.9	0.79	
Hooker	101	38	73.2	1.77	
Jefferson	99	42	73.8	1.04	
Kenton	94	42	70.5	0.66	
Kingfisher	104	44	75.4	1.66	
McComb	103	48	75.4	2.61	
Maugum	102	52	78.6	1.05	
Meeker	105	44	76.4	1.60	
Neola	102	47	76.6	1.67	
Newkirk	103	42	74.9	1.40	
Norman	105[d]	53[e]	74.6[f]	2.18	
Okeene	104	44[d]	75.8[b]	1.58	
Pawhuska	102	45	73.8	0.92	
Perry	104	43	74.5	1.59	
Sac and Fox Agency	105	46	75.6	1.30	
Shawnee	104	46	76.1	1.84	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Oklahoma—Cont'd.	°	°	°	*Ins.*	*Ins.*
Snyder	103[e]	44[e]	76.2[e]	.....	
Stillwater	104	46	73.7	0.44	
Temple	106	48	79.2	3.50	
Watonga	102	45	74.2	2.23	
Waukomis	106	43	74.4	1.59	
Weatherford	104	45	75.6	1.70	
Whiteagle	103	45	75.6	0.65	
Oregon.					
Alba	.....	.....	.....	2.06	
Albany	97	38	60.9	.....	
Ashland	93	41	60.8	1.45	
Astoria	78	49	58.1	2.92	
Aurora (near)	93	45	63.6	1.50	
Bay City	95	36	58.8	4.54	
Bend	92	25	55.4	0.96	
Black Butte	94	36	56.8	1.08	
Blalock	98	43	67.4	0.70	
Buckhorn	99	32	59.8	0.89	
Bullrun	96	38	59.8	3.27	
Burns	92	26	54.8	1.01	
Cascade Locks	92	43	62.1	3.45	
Coquille	.....	.....	.....	2.31	
Corvallis	96	34	61.0	1.17	
Dayville	96	30	59.4	0.45	
Doraville	91	38	58.7	2.15	
Drain	101	32	61.8	1.25	
Echo	95	34	63.6	0.80	
Ella	98	31	62.6	0.48	
Eugene	93	37	60.0	1.23	
Fairview	91	38	56.8	1.68	
Gardiner	86	44	66.0	2.79	
Glendale	101	32	60.4	0.96	
Glenora	98	32	58.8	5.53	
Gold Beach	85	37	56.8	2.87	
Granite	90	22	52.4	0.30	
Grants Pass	101	33	61.5	0.61	
Grass Valley	79	23	51.6	0.50	
Heisler	97	32	61.8	0.03	
Heppner	90	35	59.4	1.86	
Hermiston	100	33	63.8	0.52	
Hood River	89	35	62.8	0.66	
Huntington	90	32	64.3	0.00	
Jacksonville	98	37	63.3	0.68	
Joseph	89	28	55.3	0.93	
Klamath Falls	89	28	56.1	0.42	
La Grande	94	30	58.0	0.71	
Lakeview	89	24	56.2	2.29	
McKenzie Bridge	97	28	57.6	2.60	
McMinnville	96	36	59.7	1.31	
Marshfield	77	38	57.9	2.42	
Monroe	94[f]	40[f]	61.0[f]	0.91	
Mountain Park	86	35	57.4	1.89	
Mount Angel	98	42	64.2	3.00	
Nehalem	.....	.....	.....	6.08	
Newport	85	43	59.4	2.38	
Odell	.....	.....	.....	1.26	
Olex (near)	92	35	60.7	0.34	
Ontario	.....	.....	.....	0.25	
Orseco	84[b]	33[c]	58.4[c]	4.38	
Paisley	86[d]	33[d]	53.5[d]	1.35	
Pendleton	94	33	60.0	0.91	
Pompeii	85	32	51.8	2.96	
Port Orford	72	46	56.0	3.13	
Prineville	89	28	53.8	T.	
Richland	95	32	61.6	0.60	
Riverside	98	25	57.6	0.55	
Salem	93	42	62.6	1.84	
Silver Lake	95	23	56.1	0.87	
Stafford	98	40	62.3	2.02	
The Dalles	90	40	62.4	0.29	
Toledo	96	41	59.5	2.49	
Umatilla	101	40	66.1	0.21	
Vale	98	27	60.6	0.08	
Wallowa	91	25	54.7	1.23	
Wamic	92[d]	30[d]	55.4[d]	0.96	
Warm Spring	94	30	59.4	0.12	
Wasco	90	45	64.4	0.39	
Weston	91	31	59.2	1.38	
Williams	100	31	61.8	.....	
Yonna	88	23	52.6	0.96	
Pennsylvania.					
Aleppo	86	33	64.8	3.79	
Altoona	85	34	61.9	5.90	
Baldwin	85	42	63.8	4.32	
Beaver Dam	.....	.....	.....	5.40	
Bellefonte	88	30	65 8	5.78	
Browers Lock	.....	.....	.....	9.49	
California	89	38	67.3	4.18	
Cassandra	80	36	61.0	3.33	
Center Hall	80	35	61.0	5.06	
Clarion	.....	.....	.....	5.10	
Claysville	86	31	65.2	5.68	
Coatsville	92	38	67.8	8.24	
Confluence	.....	.....	.....	3.24	
Davis Island Dam	.....	.....	.....	2.18	
Derry	95	37	66.2	5.28	
Doylestown	.....	.....	.....	9.69	
Drifton	81	35	61.5	5.42	

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Pennsylvania—Cont'd.	°	°	°	*Ins.*	*Ins.*
East Mauch Chunk	87	34	64.6	9.03	
Easton	84	40	65.8	8.68	
Ellwood Junction				5.60	
Emporium	83	38	63.3	5.89	
Ephrata	88	37	66.1	6.61	
Everett	90	37	65.7	4.76	
Forks of Neshaminy				7.19	
Franklin	86	37	64.2	3.75	
Freeport	87	40	65.5	4.17	
George School	89	38	66.8	7.20	
Gettysburg	87	37	66.0	7.32	
Girardville				8.50	
Gordon	84	32	63.0	8.09	
Greensboro				3.82	
Greenville	86	40	63.6	4.07	
Grove City	87	38	64.2	4.01	
Hamburg	88	37	66.4	9.91	
Hanover	91	37	68.6	4.87	
Herrs Island Dam				3.66	
Huntingdon	85	36	64.8	8.28	
Hyndman	91	37	65.0	4.94	
Indiana	86	39	65.0	7.74	
Irwin	93	38	67.0	5.70	
Johnstown	90	39	66.5	5.44	
Kennett	85[a]	40[a]	66.0[a]	7.16	
Lansdale				9.03	
Lawrenceville	88	32	63.1	5.01	
Lebanon	85	39	66.5	6.20	
Le Roy	83	35	62.2	7.07	
Lewisburg	85	38	65.8	11.86	
Lock Haven	86	38	65.1	8.55	
Lock No. 4				4.85	
Lycippus	84	34	65.4	5.02	
Marion	89	37	66.4	4.82	
Mauch Chunk				9.03	
Mifflintown	86	38	64.7	7.00	
Milford	85	34	62.8	10.64	
Montrose	84	32	61.0	7.50	
New Germantown	87	36	65.7	4.62	
Ottsville				10.04	
Philadelphia	88	45	69.3	6.79	
Pocono Lake	79	29	58.1	7.54	
Point Pleasant				11.32	
Reading	88	40	67.0	8.58	
Renovo				4.91	
Saegerstown	85	38	62.8	5.35	
St. Marys	84	35	62.0	5.55	
Saltsburg				5.62	
Seisholtzville				9.19	
Selinsgrove	94	38	65.8	5.95	
Shawmont				6.24	
Skidmore	86	36	64.0	3.45	
Smiths Corners				11.25	
Somerset	85	34	62.6	5.02	
South Eaton	81	37	63.6	5.55	
Springdale				4.15	
Springmount				10.09	
State College	81	38	63.4	6.57	
Towanda	84	35	63.2	8.31	
Uniontown	86	39	66.0	4.24	
Warren	82	36	62.1	5.26	
Wellsboro	84	33	62.4	5.58	
West Chester	91	41	68.0	7.30	
West Newton				5.14	
Wilkes-Barre	85	36	65.2	6.50	
Williamsport	82	39	64.6	4.19	
Rhode Island.					
Bristol	79	46	63.5	6.19	
Kingston	84	36	62.8	6.89	
Providence				9.15	
South Carolina.					
Aiken	96	59	77.0	3.42	
Allendale	96	60	78.4	9.18	
Anderson	94	54	74.6	4.48	
Batesburg	92	55	74.4	4.10	
Beaufort	93	62	78.9	3.61	
Bennettsville	97	57	77.0	4.41	
Blackville	96	60	76.6	10.02	
Blairs				3.53	
Bowman	96	57	77.3	9.86	
Calhoun Falls				4.25	
Camden	94	53	74.1	6.98	
Catawba				7.91	
Chappells				3.97	
Cheraw	93	58	74.6	5.81	
Clarks Hill	96	56	75.2	6.88	
Clemson College	88	55	72.8	3.26	
Conway	95	59	78.2	8.55	
Darlington	97	56	76.7	4.42	
Dillon	96	56	77.6	4.11	
Edisto				8.42	
Effingham				3.80	
Florence	97	57	77.7	4.86	
Georgetown	92	64	79.1	5.04	
Greenville	88	48	69.7	6.31	
Greenwood	94	56	75.8	5.43	
Heath Spring	96	55	75.3	6.65	
Kingstree	93	60	78.1	4.72	
South Carolina—Cont'd.	°	°	°	*Ins.*	*Ins.*
Liberty	92	53	73.7	5.57	
Little Mountain	93	57	76.3	4.52	
Newberry	97	57	76.2	3.91	
Pineopolis[a1]	90	62	76.9	9.77	
St. George	92	62	77.8	8.18	
St. Matthews	92	58	74.8	7.38	
Saluda	99	50	75.8	5.44	
Santuck	96	54	75.0	7.80	
Smiths Mills				7.13	
Society Hill	91	57	75.0	5.85	
Spartanburg	94	52	74.2	6.83	
Statesburg	93	58	76.9	5.28	
Summerville	93	61	78.6	6.39	
Trenton	98	56	75.2	4.63	
Trial	94	58	77.7	6.98	
Walhalla	95	45	71.1	4.69	
Walterboro	94	61	79.1	7.39	
Winnsboro	95	56	75.4	8.00	
Winthrop College	90	54	73.6	5.81	
Yemassee	93	61	76.0	9.35	
Yorkville	94	53	75.4	5.78	
South Dakota.					
Aberdeen	83	21	54.8	2.15	
Academy	90	31	60.6	2.15	
Alexandria	92	31	60.8	1.87	
Armour	94	29[c]	60.5[d]	3.55	
Ashcroft	93	27	56.8	1.33	
Bowdle	84	24	56.2	1.60	T.
Brookings	87	24	58.2	1.28	
Canton	91	25	60.6	1.83	
Castlewood	87	17	55.4	2.52	
Centerville	91	29	60.5	3.05	
Chamberlain	91	30	61.5	0.50	
Cherry Creek	98	31	59.1	1.00	
Clark	87	20	56.3	2.11	
Clear Lake	85	24	55.9		
De Smet	90	26	57.7	0.96	
Farmingdale				1.96	2.0
Faulkton	82	19	55.6	1.66	
Flandreau	86	30	57.8	2.63	
Forestburg	90	23	56.6	1.41	
Fort Meade	90	27	57.8	1.40	
Frederick	84[c]	13[c]	54.0[d]	1.25	
Gannvalley	90	29	59.7	1.39	
Greenwood	94	32	62.8	2.06	
Hermoso	89	30	56.9	1.92	T.
Highmore	86	28[d]	58.0[b]	1.04	
Hitchcock				0.98	
Howard	88	28	58.0	0.98	
Howell	86	20	55.4	1.50	
Ipswich				0.79	
Kenebec	87	32	58.6	1.93	
Kidder	81	14	53.0	0.71	
Kimball	88	32	59.9	1.09	
La Delle	88	22	57.8	2.00	
Marion				2.54	
Mellette	85	18	55.8	1.56	
Menno	90	30	60.6	1.24	
Mill Bank	86	19	55.2	1.58	
Mitchell	91	28	58.8	2.59	
Mound City	85	19[c]	54.6[c]	1.09	
Oelrichs	91	30	56.8	0.62	
Orman	89[c]	31[d]	57.2[d]	2.13	1.0
Ramsey	90	26	57.2	5.17	
Redfield	83	19	55.3	1.83	
Rosebud	90[c]	30	58.4[b]	0.77	
Roslyn	80	20	55.0	0.68	
Sioux Falls	89	28	59.4	2.40	
Spearfish	84	32	55.6	2.71	
Stephan	85	30	58.2	1.24	
Vermillion	93	33	63.0	5.12	
Watertown	84	23	53.9	0.96	
Wentworth	90	29	58.8	2.47	
Wessington Springs	86	30	59.1	0.80	
Woolsey				0.57	
Tennessee.					
Arlington	97	42	71.5	1.32	
Ashwood	93	42	70.6	3.28	
Benton	94	46	72.0	7.73	
Birds Bridge				5.52	
Bluff City				6.06	
Bolivar	95	44	71.0	1.76	
Bristol	91	42	69.8	3.85	
Brownsville	96	43	71.8	1.17	
Byrdstown	88	48	70.0	4.29	
Carthage	97	41	72.4	3.30	
Cedar Hill	94	43	70.6	2.65	
Celina				4.81	
Charleston				7.62	
Clarksville	93	44	70.6	2.14	
Clinton				8.51	
Covington	95	45	72.2	2.40	
Dandridge				5.41	
Decatur	96	45	71.4	8.13	
Dickson	95	46	71.4	0.78	
Dover	99	39	72.4	2.59	
Dyersburg	96	46	72.4	1.80	
Elizabethton	90	41	69.3	2.70	
Tennessee—Cont'd.	°	°	°	*Ins.*	*Ins.*
Erasmus	92	35	66.2	7.57	
Florence	90	44	70.6	3.49	
Franklin	93	44	70.1	3.27	
Harriman				4.15	
Hohenwald	94	40	69.1	1.21	
Iron City	78	40	70.2	7.99	
Jackson	97	44	72.6	2.92	
Johnsonville	93	41	71.1	2.93	
Jonesboro	87	41	68.0	6.10	
Kenton	101	43	72.8	1.85	
Kingston				7.07	
Lafayette	96	38	70.2	3.31	
Lewisburg	95	41	71.2	6.79	
Loudon				9.60	
Lynnville	91	47	69.2	5.74	
McGee				8.74	
McMinnville	97	42	70.6	6.19	
Maryville	96	47	71.6	8.09	
Milan	96	45	69.7	2.52	
Newport	87	46	69.0	5.89	
Palmetto	95	42	71.8	6.56	
Pinewood	98[d]	38[d]	71.2[d]	1.83	
Popo	98	40	71.8	3.20	
Rogersville	91	43	69.8	6.78	
Rugby	90	36	66.9	6.20	
Savannah	96	41	71.8	3.65	
Sevierville	95	43	70.6	6.46	
Sewanee	90	47	69.0	5.54	
Silver Lake	80	31	63.6	7.36	
Sparta	93	40	70.6	7.47	
Springdale	92	42	67.8	5.03	
Springville	96	41	70.0	5.34	
Tazewell				6.54	
Tellico Plains	93	44	71.6	7.02	
Tracy City	90	43	66.3	6.12	
Trenton	101	41	71.6	3.47	
Tullahoma	96	43	70.6	4.66	
Union City	98[c]	44[c]	72.6[c]	1.95	
Walling				10.09	
Waynesboro	95	42	70.6	5.00	
Wildersville	92	43	70.4	2.87	
Yukon	96	46	71.8	5.81	
Texas.					
Albany	106	52	80.0	1.20	
Alvin				6.03	
Arthur				1.74	
Austin	96	53	76.6	0.97	
Ballinger	101	51	78.3	2.40	
Barstow	94	48	74.5	0.86	
Beaumont	110	70	88.6	4.01	
Beeville	102	66	84.0	1.51	
Big Spring	101	53	79.4	2.79	
Blanco	100	49	77.6	0.86	
Boerne	102	52	78.8	1.70	
Bonham	102	47	76.8	1.45	
Booth				3.44	
Bowie	105	48	80.8	0.81	
Brazora	99	53	80.8	1.20	
Brenham	98	56	78.8	1.93	
Brighton	93	64	80.9	2.37	
Brownsville	96	68	82.3	1.59	
Brownwood	103	50	79.4	0.64	
Canadian	93	43	72.9	1.45	
Carmona	103	48	78.8	5.45	
Channing	92	41	71.1	2.47	
Childress	101	47	77.3	1.50	
Chillicothe				1.71	
Clarksville	104	52	79.9	1.05	
Claude	92	40	70.5	0.60	
Claytonville	96	51	74.4	0.50	
Coleman	98	56	79.1	0.72	
College				0.90	
Colorado	103	48	78.5	0.17	
Corsicana	100	50	79.4	3.77	
Crockett	104	51	80.2	4.52	
Cross Bar Ranch				3.95	
Cuero	98	58	78.7	2.87	
Dallas	103	52	78.9	1.12	
Danevang	99	51	80.3	1.04	
Decatur	99	60	79.0	0.63	
Denison				1.79	
Dialville	96	54	78.0	3.41	
Dublin	100	55	80.1	0.60	
Duval	99	56	80.6	0.31	
Eagle Pass	107	62	82.6	5.34	
Earls Ranch				1.26	
Falfurrias	108	62	83.0	1.94	
Fort Clark	99	55	78.2	1.60	
Fort Davis	91	45	70.4	0.28	
Fort McIntosh	105	60	84.4	1.79	
Fort Stockton	102	54	78.2	0.85	
Fredericksburg	96	52	77.4	4.09	
Gainesville	104	52	80.2	3.26	
Gatesville	102	48	79.6	1.45	
Georgetown	102	48	81.0	0.84	
Gonzales				1.20	
Graham	109	50	83.4	0.63	
Grapevine	105	55	80.8	1.73	

TABLE II.—*Climatological record of cooperative observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Texas—Cont'd.	°	°	°	*Ins.*	*Ins.*
Greenville	104	53	80.2	0.34	
Hale Center	95	39	70.6	0.15	
Hallettsville	99	57	81.4	1.10	
Hebbronville	....	....	....	1.98	
Hempstead	....	....	....	1.28	
Henrietta	110	51	81.5	1.30	
Hondo	101	58	81.4	1.06	
Houston	100	56	80.2	5.15	
Hubbard	100	58	80.0	1.87	
Huntsville	98	51	78.4	1.81	
Jewett	100	43	78.4	2.91	
Junction	....	....	....	0.90	
Kaufmann	103	54	80.0	1.82	
Keene	104	54	80.8	0.70	
Kerrville	100	48	78.4	0.74	
Knickerbocker	102	52	79.6	1.53	
Kopperl	....	....	....	2.60	
Lampasas	100	47	78.1	1.49	
Lapara	....	....	....	1.79	
Laureles	....	....	....	1.76	
Liberty	104	53	80.0	5.75	
Llano	99	51	80.5	T.	
Lone Star Ranch	....	....	....	0.00	
Longview	99	50	78.8	0.13	
Lufkin	106	53	80.0	2.22	
Luling	99	57	80.7	0.99	
McLean	93	40	71.2	1.39	
Marfa	....	....	....	0.90	
Memphis	103	60	83.4	3.98	
Mexia	101	51	79.0	2.90	
Miami	99	42	72.8	1.80	
Mount Blanco	97	48	74.5	0.17	
Nacogdoches	99	52	78.4	0.63	
Ochiltree	....	....	....	2.56	
Panter	....	....	....	0.35	
Paris	102	52	77.9	1.02	
Pierce	92	50	76.6	2.49	
Plemons	93	38	69.8	1.02	
Port Lavaca	99	62	81.9	3.60	
Quanah	103	46	78.4	0.00	
Rhineland	....	....	....	0.35	
Riverside	....	....	....	3.27	
Rock Island	97	52	80.2	0.37	
Rockland	....	....	....	1.39	
Rossville	....	....	....	0.58	
Runge	....	....	....	0.00	
Sabinal	107	58	83.8	1.21	
San Angelo	103	58	80.5	0.31	
San Marcos	97	54	79.2	0.84	
San Saba	100	50	78.8	1.39	
Santa Gertrudes	....	....	....	0.65	
Seymour	102	46	79.0	0.51	
Sherman	96	55	79.8	2.87	
Sugarland	98	52	79.4	3.78	
Sulphur Springs	101	51	78.0	1.07	
Temple	102	48	79.0	0.80	
Tilden	106	55	83.7	0.91	
Tulia	....	....	....	1.25	
Valley Junction	99	55	81.8	1.28	
Waco	98	54	79.1	1.61	
Waxahachie	105	48	78.4	2.17	
Wharton	102	49	80.4	0.80	
Wichita Falls	104	49	79.0	1.10	
Willis	104	54	80.7	2.62	
Wills Point	102	53	79.0	0.61	
Utah.					
Alpine	....	....	....	0.40	
Aneth	100	35	69.4	0.35	
Castle Dale	94	26	58.6	0.62	
Castle Rock	....	....	....	0.00	
Cedar City	86	32	61.5	0.53	
Corinne	97	35	66.6	T.	
Coyote	....	....	....	0.80	
Deseret	90	26	60.0	0.87	
Emery	79	30	56.6	0.90	
Escalante	88	29	59.2	0.33	
Experiment Farm	97	36	68.0	....	
Farmington	83	31	57.9	0.10	
Fillmore	94	31	64.4	1.24	
Government Creek	89	29	60.6	0.33	
Grayson	85	28	62.0	0.60	
Heber	86	26	55.0	T.	
Henefer	86	22	55.4	0.37	
Hite	97	47	72.9	0.21	
Huntsville	....	....	....	0.18	
Ibapah	81	24	53.8	0.62	2.0
Kanosh	....	....	....	0.38	
Kelton [21]	86	40	62.1	0.10	
Levan	84	33	59.0	0.91	
Lon	76	22	50.0	0.10	
Logan	83	39	61.0	0.12	
Lucin	91	17	54.8	0.40	
Marysvale	84	25	56.9	0.50	T.
Meadowville	79	25	53.8	1.55	
Milford	89	25[d]	58.4[b]	0.02	
Millville	....	....	....	0.35	
Minersville	....	....	....	0.15	
Moab	92	34	66.4	0.60	
Morgan	85	26	56.7	0.34	
Mount Nebo	89	33	62.3	....	
Nephi	....	....	....	0.64	
Oak City	95	31	63.0	0.91	
Parowan	86	28	58.7	0.33	
Park City	80	25	54.8	0.44	
Payson	....	....	....	0.53	
Plateau	85	23	54.9	0.47	
Provo	90	32	62.8	0.40	T.
Ranch	85	25	54.1	0.10	
Randolph	....	....	....	0.26	
Richfield	97	30	61.4	0.43	
St. George	100	40	72.2	0.33	
Saltair	81	32	59.1	T.	
Scipio	86	24	58.7	0.73	
Silver Lake	79	23	50.2	0.36	
Snowville	87	27	53.7	0.05	
Soldier Summit	74	22	49.4	0.15	
Springdale	97	36	71.2	0.41	
Sunnyside	....	....	....	0.40	T.
Theodore	85	32	58.6	0.09	
Thistle	91	25	59.8	....	
Tooele	86	37	62.8	0.05	
Tropic	89	26	59.0	0.26	T.
Trout Creek	92	24	58.0	0.37	
Verdure	....	....	....	1.96	
Woodruff	111	19	52.5	2.59	
Vermont.					
Bloomfield	81	32	56.6	5.80	
Cavendish	87	32	58.2	6.71	
Chelsea	79	32	55.6	8.18	
Enosburg Falls	84	35	59.2	5.41	
Jacksonville	82	32	57.0	8.26	
Manchester	80	38	58.6	8.03	
Norwich	....	....	....	6.72	
St. Johnsbury	86	36	58.8	8.11	
Wells	80	36	59.1	8.29	
Woodstock	80	34	56.0	7.07	
Virginia.					
Arvonia	93	39	70.4	4.25	
Ashland	93	44	71.6	4.23	
Bigstone Gap	85	40	66.9	5.62	
Blacksburg	89	36	65.9	6.83	
Burkes Garden	80	30	60.8	5.43	
Callaville	90	45	72.9	9.19	
Charlottesville	89	41	70.6	6.71	
Columbia	88	42	69.6	5.61	
Culpeper	90	39	68.5	5.62	
Dale Enterprise	90	34	67.2	5.81	
Danville	....	....	....	2.60	
Dinwiddie	92	36	71.4	3.38	
Doswell	94	41	72.0	4.47	
Elk Knob	84	43	67.4	6.75	
Fredericksburg	92	42	70.6	5.98	
Galax	86	37	65.6	7.72	
Hampton	87	49	71.2	1.30	
Hot Springs	80	35	62.4	5.38	
Ivanhoe	....	....	....	9.83	
Lexington	89	40	66.9	8.79	
Lincoln	92	40	69.2	8.10	
Marion	85	36	66.6	5.50	
Max Meadows	85	37	66.4	....	
Newport News	92	49	75.0	2.83	
Nokesville (near)	90	41	68.0	4.30	
Petersburg	92	45	73.5	5.80	
Quantico	89	40	67.7	6.43	
Radford	....	....	....	6.52	
Roanoke	93[b]	42[b]	69.6[b]	....	
Rocky Mount	90	40	69.4	6.17	
Saxe	97	49	74.4	2.94	
Shenandoah	....	....	....	6.04	
Speers Ferry	....	....	....	5.26	
Spottsville	92	42	72.6	4.73	
Staunton	89	39	69.0	7.29	
Stephens City	91	34	67.4	6.81	
Warsaw	90	38	71.0	3.13	
Williamsburg	92	45	71.5	5.30	
Woodstock	92	36	68.4	5.70	
Washington.					
Aberdeen	93	30	57.8	3.04	
Anacortes	83	40	57.4	2.61	
Ashford	....	....	....	5.81	
Baker	91[d]	40	60.1[b]	1.82	
Bellingham	77	35	56.8	1.17	
Blaine	82	31	56.6	1.81	
Cedar River	....	....	....	4.40	
Centralia	94	33	58.2	3.96	
Cheney	89	34	61.0	1.55	
Clearbrook	90	29	57.6	2.13	
Clearwater	89	36	59.2	5.04	
Cle Elum	87	25	54.6	0.58	
Colfax	86	32	54.4	0.97	
Coleville	90	30	56.4	1.99	
Conconully	87	32	57.0	1.24	
Coupeville	86	41	58.0	3.73	
Crescent	88	31	56.2	1.30	
Cusick	83	34	56.2	2.05	
Dayton	88	34	59.6	0.86	
East Sound	79	34	56.1	1.43	
Ellensburg	89	31	57.4	1.20	
Ephrata	92	33	61.4	1.70	
Gardena	97	33	63.2	0.63	
Granite Falls	....	....	....	6.27	
Hatton	95	30	61.3	0.39	
Hoodsport	92	38	60.7	3.62	
Huntsville	....	....	....	0.59	
Kennewick	97	36	62.6	0.18	
Kiona	97	35	63.8	0.46	
Lacenter	94	37	59.0	2.58	
Lakeside	92	42	63.1	1.84	
Lester	96	31	58.2	1.65	
Mottinger Ranch	99	44	66.8	0.73	
Mount Pleasant	90	41	61.8	2.64	
Moxee	96	31	60.9	1.36	
Northport	82	31	53.6	2.02	
Odessa	88	30	58.8	....	
Olga	79	43	56.4	1.91	
Olympia	87	36	58.7	3.79	
Pinehill	94	37	60.8	0.49	
Pomeroy	90	30	59.5	1.34	
Port Townsend	82	44	57.8	2.17	
Prosser	88	30	59.7	0.98	
Ritzville	....	....	....	0.39	
Rock Lake	....	....	....	1.26	
Rosalia	86	30	55.8	1.19	
Sedro-Woolley	81	38	56.9	3.75	
Sixprong	97	42	63.9	0.91	
Snohomish	84	38	56.6	4.99	
Snoqualmie	90	38	59.0	2.98	
South Bend	87	40	64.0	....	
Stehekin	85	38	58.3	1.53	
Sunnyside	90	34	59.0	0.83	
Twisp	89	33	59.2	1.34	
Vancouver	95	36	61.8	2.17	
Vashon	79	39	57.2	3.91	
Wahluke	96	34	63.0	0.26	
Waterville	88	32	58.0	1.26	
Wenatchee (near)	86	39	60.0	2.26	
Wilbur	90	29	57.6	1.35	
Winthrop	85	30	59.6	1.02	
Yale	98	40	62.1	3.52	
Zindel	102	42	66.4	0.49	
West Virginia.					
Bancroft	91	40	68.8	2.12	
Bayard	83	30	60.7	4.75	
Beckley	84	35	61.0	2.65	
Bens Run	89	40	68.0	3.91	
Burlington	88	35	66.2	5.96	
Cairo	90	36	68.0	5.88	
Central	85	33	65.2	6.88	
Charleston	88	40	68.7	2.59	
Creston	87	37	66.3	2.74	
Cuba	88	34	66.6	3.13	
Davis	....	....	....	4.20	
Doane	93	39	69.1	2.04	
Elkhorn	85	39	67.0	3.96	
Fairmont	87	34	66.2	3.80	
Franklin	87	34	65.3	5.47	
Glenville	89	39	68.3	5.14	
Grafton	85	34	66.1	5.94	
Harpers Ferry	....	....	....	4.91	
Hinton	84[c]	45[c]	68.2[c]	4.99	
Huntington	90	41	68.6	2.00	
Leonard	78	38	62.4	3.45	
Lewisburg	87	36	66.0	4.48	
Logan	88	45	67.9	3.97	
Lost City	88	38	64.2	6.71	
Lost Creek	87	33	65.6	3.22	
Madison	91	44	69.0	3.48	
Mannington	87	35	65.8	3.87	
Martinsburg	89	39	66.0	6.25	
Moorefield	92	32	66.0	5.85	
Mooresville	....	....	....	3.38	
Morgantown	87	35	66.0	4.97	
Moundsville	88	38	67.8	4.41	
New Cumberland	90	36	65.6	3.44	
New Martinsville	89	39	68.2	5.71	
Nuttallburg	72	36	55.0	3.96	
Oceana	93	42	69.6	4.53	
Parsons	85	36	63.7	3.00	
Philippi	87	34	65.0	4.56	
Pickens	81	33	62.8	3.43	
Point Pleasant	89	40	69.7	2.12	
Powellton	89	40	69.4	2.16	
Princeton	82	35	61.9	5.00	
Romney	91	36	66.2	6.33	
Rowlesburg	....	....	....	3.65	
Ryan	87	35	66.3	4.40	
Smithfield	86	39	64.8	2.75	
Southside	86	38	66.8	3.72	
Spencer	85	35	63.6	3.94	
Sutton	90	43	69.4	5.90	
Terra Alta	81	34	61.6	7.03	
Union	86	34	65.6	4.15	
Uppertract	90	33	65.8	5.40	
Valley Fork	90	43	69.0	4.30	

TABLE II.—*Climatological record of cooperative observers*—Continued. *Late reports for August, 1907.*

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
West Virginia—Cont'd.	°	°	°	*Ins.*	*Ins.*
Webster Springs	88	38	67.4	4.92	
Wellsburg	81	38	64.7	3.58	
Weston	88	36	65.3	5.80	
Wheeling	94	32	67.6	5.45	
Williamson	90	48	70.4	3.60	
Wisconsin.					
Antigo	85[c]	30[c]	56.2[c]	.....	
Appleton	89	33	59.8	3.45	
Appleton Marsh	84	28	57.4	2.90	
Ashland	82	29	56.6	2.99	
Beloit	90	35	60.6	6.20	
Brodhead	91	33	61.8	7.88	
Burnett	85	32	59.4	3.49	
Butternut	90	24	54.5	8.91	
Cecil	86	30	59.2	4.91	
Chilton	87	32	57.8	3.54	
Citypoint	84[b]	26[b]	53.8[b]	.....	
Cranden	82	28	54.8	3.84	T.
Delaven	93	31	60.6	4.60	
Downing	88	22	57.1	5.06	
Eau Claire	84	28	59.3	3.65	
Florence	82	26	54.5	4.45	T.
Fond du Lac	89	32	59.5	4.83	
Grand Rapids	84	29	58.5	2.58	
Grand River Locks	.....	.....	.....	3.97	
Grantsburg	83	23	55.2	9.38	
Hancock	84	29	59.0	2.64	
Hayward	80	20	55.2	8.50	
Herbster	70	25	49.4	5.03	
Hillsboro	85	26	58.4	3.15	
Koepenick	82	24	54.9	7.50	
Lake Mills	90	32	59.8	5.94	
Lancaster	86	30	60.6	6.74	
Manitowoc	89	36	58.6	5.19	
Mauston	83	29	56.8	4.02	
Meadow Valley	85	26	56.2	3.48	
Medford	87	27	58.3	5.10	
Menasha	.....	.....	.....	2.45	
Merrill	88	28	56.1	6.61	
Minocqua	76	30	55.4	7.62	
Mount Horeb	87	26	59.2	5.62	
Neillsville	85	25	57.0	3.74	
New London	85	30	59.0	3.63	
New Richmond	85	25	57.5	2.98	
Oconto	88	32	59.3	4.77	
Osceola	86	24	56.4	7.33	
Oshkosh	89[c]	32[c]	59.8[c]	2.91	
Pine River	85	30	59.0	2.84	
Portage	83	32	59.6	3.56	
Port Washington	89	36	59.0	7.35	
Prairie du Chien	87	30	61.4	6.43	
Prentice	85	31	55.4	4.82	
Racine	96	34	62.6	4.87	
Sheboygan	92	38	60.8	5.16	
Shullsburg	88	31	59.7	6.86	
Solon Springs	82	22	55.8	2.51	
Spooner	81	28	56.0	6.73	
Stanley	81	23	56.8	3.74	
Sturgeon Bay	89	34	58.6	5.68	
Valley Junction	83	26	57.6	4.15	
Viroqua	82	30	59.0	5.44	
Watertown	89	32	58.8	5.53	
Waukesha	.....	.....	.....	5.21	
Waupaca	89	27	59.8	2.79	
Wausau	83	28	57.2	4.38	
Weyerhauser	82	26	55.3	5.72	
Whitehall	89[c]	26[c]	59.8[c]	.....	
Wyoming.					
Barnum	.....	.....	.....	1.31	
Basin	90	33	61.0	1.37	
Bedford	78	20	51.2	.....	
Blue Cap	75	26	49.4	1.24	2.5
Border	80	20	51.2	0.34	
Buffalo	92[1]	34	56.2[c]	2.37	
Camp Colter	84	32	56.2	0.73	
Chugwater	88	29	57.5	1.24	1.0
Clark	83	33	58.3	1.51	T.
Clear Creek Cabin	77[d]	26[d]	50.5[d]	1.26	.....
Daniel	75	18	47.0	0.47	
Dubois	80	11	45.1	0.30	
Etons Ranch	83	36	55.4	1.40	
Elk Mountain	.....	.....	.....	1.53	
Embar	80	31	53.2	1.50	
Evanston	77	22	52.0	0.57	
Experiment Farm	.....	.....	.....	0.74	1.5
Fayette	79	20	50.0	0.60	
Fontenelle	79	18	50.2	0.20	
Fort Laramie	96	27	59.4	1.51	
Granite Canyon	79	23	53.4	0.78	3.0
Granite Springs	81	28	55.8	1.25	3.5
Green River	85	23	56.0	0.64	T.
Griggs	88	28	54.8	1.74	
Hatton	.....	.....	.....	0.47	
Hyattville	87	32	57.1	.....	
Kirtley	84	26	55.6	1.10	6.5
Laramie	80	24	53.8	0.62	0.3
Leo	80	22	53.9	0.12	2.0
Lolabama Ranch	72	25	48.0	0.64	5.0
Wyoming—Cont'd.	°	°	°	*Ins.*	*Ins.*
Lusk	84	28	54.8	1.35	
Moorcroft	84	32	54.3	1.55	
Moore	84[c]	27[c]	56.4[c]	.....	1.0
Newcastle	86	32	60.0	1.68	
Pathfinder	86	31	58.5	0.63	0.5
Phillips	85	30	57.5	1.14	0.5
Pine Bluff	91	29	60.0	0.67	
Pinedale	75	20	49.4	0.43	
Rawlins	81	29	56.6	0.39	T.
Riverton	87	32	58.6	0.52	
Saratoga	81[c]	23[c]	54.7[c]	.....	1.5
Sheridan	85	32	56.0	2.75	
South Pass City	72	15	43.9	0.20	2.0
Wells	68	15	43.6	1.05	2.0
Wheatland	89	29	61.4	2.35	5.0
Worland	.....	.....	.....	1.33	
Wyncote	89	32	60.1	1.53	0.5
Yellowstone Pk. (Fount.)	73	19	47.3	0.18	
Yellowstone Pk. (G. Can.)	.....	.....	.....	1.64	
Yellowstone Pk. (Lake)	72[b]	22[b]	44.6[b]	.....	
Yellowstone Pk. (Norris)	75	12[j]	45.6[c]	0.87	
Yellowstone Pk. (Riv'side)	79	18	47.0	1.55	
Yellowstone Pk. (S. River)	75[b]	19[a]	47.2[c]	0.26	
Yellowstone Pk. (Soda B.)	76	15	47.2	0.90	
Yellowstone Pk. (T. Sta.)	72	21	47.0	1.12	
Yellowstone Pk. (Up. Ba.)	82	21	48.6	0.95	T.
Porto Rico.					
Aguirre	97	71	82.9	2.87	
Albonito	89	59	75.4	8.10	
Alto de La Bandera	84	65	74.4	11.87	
Arecibo	91	61	75.6	10.27	
Barros	88	61	75.1	8.15	
Bayamon	96	66	80.6	6.73	
Caguas	95	63	78.2	4.74	
Canovanas	91	73	80.8	7.48	
Cayey	90	69	75.3	4.11	
Cidra	90	64	76.6	4.52	
Coloso	91	68	79.0	6.59	
Corozal	91[j]	65	79.0[c]	7.80	
Culebra	88	71	80.3	3.01	
Fajardo	91	71	82.1	4.97	
Guanica	95	66	80.6	5.02	
Guayama	.....	.....	.....	5.31	
Humacao	91	69	79.1	7.23	
Ingenio	.....	.....	.....	8.78	
Isabela	92	69	80.4	5.67	
Isolina	90	61	75.3	16.39	
La Carmelita	88	64	75.3	13.36	
Lares	93	61	76.8	9.19	
Las Marias	89	60	75.2	12.51	
Manati	89	69	78.0	5.11	
Maricao	90	62	75.4	13.55	
Maunabo	94	72	82.6	5.11	
Mayagues	92	64[c]	78.3[b]	10.60	
Penuelas	.....	.....	.....	4.26	
Ponce	95	69	81.2	6.35	
Rio Blanco	90	66	78.3	12.95	
Rio Piedras	.....	.....	.....	7.33	
San German	94	64	79.3	8.16	
San Lorenzo	94	62	77.1	11.89	
San Salvador	88[b]	65	75.4[c]	8.91	
Santa Isabel	93	69	80.7	2.63	
Vieques	92	70	82.8	2.49	
Yauco	93	65	79.0	4.76	
New Brunswick.					
St. John	67	38	54.7	4.72	
Nicaragua.					
Bluefields	88	74	80.5	19.82	
Colorado.	°	°	°	*Ins.*	*Ins.*
Eureka	.....	.....	.....	3.63	
Moraine	84	37	60.5	.....	
Silt	90	45	66.5	1.81	
Connecticut.					
Wallingford	.....	.....	.....	1.09	
Florida.					
Fort Pierce	93	66	80.3	2.89	
Plant City	94	68	78.9	10.29	
Idaho.					
Albion [1]	96	29	65.6	.....	
Massachusetts.					
Brockton	94	48	68.4	1.52	
North Billerica	92	46	66.7	0.95	
Michigan.					
Allegan	96	40	67.2	1.50	
Mississippi.					
Jackson	98	67	81.8	3.56	
Nevada.					
Mina [2]	101	47	75.6	.....	
New Hampshire.					
Bethlehem	.....	.....	.....	1.91	
North Dakota.					
Beach	97	33	63.8	1.23	
Flasher [3]	92	20	65.4	.....	
Glenullen	100	32	65.2	1.10	
Lisbon	100	29	65.3	0.61	
Medora	98	30	65.6	1.12	
Schafer	101	28	62.2	0.50	
Oregon.					
Cascade Locks	88	46	64.9	1.80	
Warmspring	97	35	63.5	0.66	
South Dakota.					
Seim	.....	.....	.....	0.87	
Texas.					
Dalhart	98	50	75.1	5.40	
Huntsville	100	67	85.0	1.00	
La Para	.....	.....	.....	1.77	
Utah.					
Cedar City	98	37	69.9	2.43	
Verdure	.....	.....	.....	1.98	
Virginia.					
Marion	90	48	69.8	5.37	
Washington.					
Bogachiel	90	37	63.6	.....	
Rattlesnake	95	41	61.6	1.64	
West Virginia.					
Southside	91	52	71.2	6.62	

Late reports for August, 1907.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Alaska.					
Black Point	.....	.....	.....	2.85	
Coal Harbor	64	36	49.6	4.90	
Chestochina	87	28	54.0	2.21	
Circle	85	29	57.7	2.79	
Dutch Harbor	.....	.....	.....	3.25	
Fort Egbert	.....	.....	.....	1.98	
Fort Gibbon	90	33	56.1	2.31	
Ketchemstock	75[j]	23	50.4[c]	2.14	
Loring	77	39	56.1	9.75	
Nome	69	30	49.8	2.68	
North Fork	74	26	50.2	3.19	
Skagway	76	43	57.6	1.98	
Sunrise	68	35	51.2	2.29	
Taylor	.....	.....	.....	0.96	
Teikhell	103	29	55.8	0.20	
Tyonok	73	37	55.4	3.05	
Wood Island	65	41	54.0	3.70	
California.					
Butte Valley	.....	.....	.....	T.	
Georgetown	95	46	70.8	0.00	
Laytonville	.....	.....	.....	0.00	
Ozena	.....	.....	.....	0.00	
San Miguel Island	.....	.....	.....	0.00	
Sonoma	.....	.....	.....	0.00	

EXPLANATION OF SIGNS.

° Extremes of temperature from observed readings of dry thermometer.

A numeral following the name of a station indicates the hours of observation from which the mean temperature was obtained, thus:

[1] Mean of 7 a. m. + 2 p. m. + 9 p. m. + 9 p. m. + 4.
[2] Mean of 8 a. m. + 8 p. m. + 2.
[3] Mean of 7 a. m. + 7 p. m. + 2.
[4] Mean of 6 a. m. + 6 p. m. + 2.
[5] Mean of 7 a. m. + 2 p. m. + 2.
[6] Mean of readings at various hours reduced to true daily mean by special tables.

The absence of a numeral indicates that the mean temperature has been obtained from daily readings of the maximum and minimum thermometers.

An italic letter following the name of a station, as "Livingston *a*," "Livingston *b*," indicates that two or more observers, as the case may be, are reporting from the same station. A small roman letter following the name of a station, or in figure columns, indicates the number of days missing from the record; for instance, "[a]" denotes 14 days missing.

No note is made of breaks in the continuity of temperature records when the same do not exceed two days. All known breaks of whatever duration, in the precipitation record receive appropriate notice.

CORRECTIONS.

July, 1907.

New Mexico: San Rafael, make precipitation 0.94.

TABLE III.— *Wind resultants, from observations at 8 a. m. and 8 p. m., daily, during the month of September, 1907.*

Stations.	Component direction from—				Resultant.	
	N.	S.	E.	W.	Direction from—	Duration.
New England.	*Hours.*	*Hours.*	*Hours.*	*Hours.*	°	*Hours.*
Eastport, Me	15	25	11	24	s. 52 w.	16
Portland, Me	16	20	16	24	s. 63 w.	9
Concord, N. H. †	10	11	7	11	s. 76 w.	4
Burlington, Vt. †	7	14	8	8	s.	7
Northfield, Vt	10	44	3	9	s. 10 w.	34
Boston, Mass	12	20	14	25	s. 54 w.	14
Nantucket, Mass	7	28	13	23	s. 25 w.	23
Block Island, R. I	10	26	14	25	s. 34 w.	19
Providence, R. I	14	20	13	26	s. 65 w.	14
Hartford, Conn	20	26	5	16	s. 61 w.	12
New Haven, Conn	17	21	13	21	s. 63 w.	9
Middle Atlantic States.						
Albany, N. Y	14	30	8	15	s. 24 w.	18
Binghamton, N. Y. †	8	5	13	9	n. 53 e.	5
New York, N. Y	13	23	12	21	s. 42 w.	14
Harrisburg, Pa	17	14	18	25	n. 67 w.	8
Philadelphia, Pa	18	24	12	24	s. 63 w.	13
Scranton, Pa	14	26	12	27	s. 51 w.	19
Atlantic City, N. J	16	25	11	26	s. 59 w.	18
Cape May, N. J	13	28	15	16	s. 4 w.	15
Baltimore, Md	16	18	14	25	s. 80 w.	11
Washington, D. C	24	18	12	23	n. 61 w.	12
Lynchburg, Va	18	18	13	18	w.	5
Mount Weather, Va	14	24	9	28	s. 62 w.	22
Norfolk, Va	12	31	20	8	s. 32 e.	22
Richmond, Va	16	27	22	9	s. 50 e.	17
Wytheville, Va	14	15	15	30	s. 86 w.	15
South Atlantic States.						
Asheville, N. C	19	23	18	10	s. 63 e.	9
Charlotte, N. C	12	28	23	12	s. 34 e.	19
Hatteras, N. C	10	22	19	24	s. 23 w.	13
Raleigh, N. C	18	25	12	19	s. 45 w.	10
Wilmington, N. C	17	22	21	19	s. 22 e.	5
Charleston, S. C	14	21	20	17	s. 23 e.	8
Columbia, S. C	15	27	19	15	s. 18 e.	13
Augusta, Ga	15	25	22	12	s. 45 e.	14
Savannah, Ga	14	23	19	18	s. 6 e.	9
Jacksonville, Fla	7	29	23	15	s. 20 e.	23
Florida Peninsula.						
Jupiter, Fla	4	27	21	18	s. 7 e.	23
Key West, Fla	8	19	39	5	s. 72 e.	36
Tampa, Fla	18	14	23	11	n. 80 e.	22
Eastern Gulf States.						
Atlanta, Ga	16	19	27	13	s. 78 e.	14
Macon, Ga. †	8	10	11	5	s. 72 e.	6
Thomasville, Ga	14	22	24	10	s. 60 e.	16
Pensacola, Fla. †	17	4	11	5	n. 25 e.	14
Anniston, Ala	19	20	24	11	s. 86 e.	13
Birmingham, Ala	24	9	27	12	n. 45 e.	21
Mobile, Ala	29	16	13	12	n. 4 e.	4
Montgomery, Ala	16	17	25	12	s. 86 e.	13
Meridian, Miss	19	11	26	19	n. 41 e.	11
Vicksburg, Miss	20	14	27	10	n. 71 e.	18
New Orleans, La	22	16	23	13	n. 59 e.	12
Western Gulf States.						
Shreveport, La	19	20	29	9	s. 87 e.	20
Bentonville, Ark. †	8	13	11	3	s. 58 e.	9
Fort Smith, Ark	13	8	38	11	n. 80 e.	28
Little Rock, Ark	18	19	25	11	s. 86 e.	14
Corpus Christi, Tex	10	31	31	6	s. 50 e.	50
Fort Worth, Tex	9	32	25	10	s. 29 e.	26
Galveston, Tex	15	22	26	10	s. 66 e.	18
Palestine, Tex	17	21	23	8	s. 75 e.	16
San Antonio, Tex	10	18	41	3	s. 78 e.	39
Taylor, Tex. †	8	13	8	9	s. 11 w.	11
Ohio Valley and Tennessee.						
Chattanooga, Tenn	23	19	15	17	n. 27 w.	4
Knoxville, Tenn	27	12	20	19	n. 4 e.	15
Memphis, Tenn	20	18	25	11	n. 82 e.	14
Nashville, Tenn	17	12	23	16	n. 54 e.	9
Lexington, Ky. †	4	15	3	12	s. 39 w.	14
Louisville, Ky	15	27	8	22	s. 49 w.	18
Evansville, Ind. †	13	12	8	6	n. 63 e.	2
Indianapolis, Ind	18	24	12	20	s. 53 w.	10
Cincinnati, Ohio	12	25	21	19	s. 9 e.	13
Columbus, Ohio	12	29	11	21	s. 30 w.	20
Pittsburg, Pa	13	24	5	32	s. 68 w.	29
Parkersburg, W. Va	9	27	19	20	s. 3 w.	18
Elkins, W. Va	19	21	12	19	s. 74 w.	7
Lower Lake Region.						
Buffalo, N. Y	11	21	15	27	s. 50 w.	16
Canton, N. Y. †	5	12	8	13	s. 36 w.	9
Oswego, N. Y	11	29	11	20	s. 27 w.	20
Rochester, N. Y	6	26	15	29	s. 35 w.	24
Syracuse, N. Y	9	26	13	20	s. 22 w.	18
Erie, Pa	9	26	13	23	s. 30 w.	20
Cleveland, Ohio	8	32	16	21	s. 12 w.	24
Sandusky, Ohio †	2	15	1	18	s. 52 w.	22
Toledo, Ohio	9	24	8	32	s. 58 w.	28
Detroit, Mich	7	23	11	28	s. 47 w.	23
Upper Lake Region.						
Alpena, Mich	18	18	16	24	w.	8
Escanaba, Mich	23	13	16	20	n. 22 w.	11
Grand Haven, Mich	17	23	10	21	s. 61 w.	12
Grand Rapids, Mich	11	21	8	32	s. 67 w.	26
Houghton, Mich. †	7	5	12	14	n. 45 w.	3
Marquette, Mich	23	14	12	28	n. 61 w.	18
Port Huron, Mich	13	20	14	25	s. 58 w.	13
Sault Sainte Marie, Mich	16	14	22	21	n. 45 e.	1
Chicago, Ill	16	23	6	30	s. 74 w.	25
Milwaukee, Wis	12	15	8	37	s. 84 w.	29
Green Bay, Wis	14	19	10	30	s. 76 w.	21
Duluth, Minn	26	3	18	27	n. 21 w.	25

Stations.	Component direction from—				Resultant.	
	N.	S.	E.	W.	Direction from—	Duration.
North Dakota.	*Hours.*	*Hours.*	*Hours.*	*Hours.*	°	*Hours.*
Moorhead, Minn	27	16	15	18	n. 15 w.	11
Bismarck, N. Dak	30	7	15	21	n. 15 w.	24
Devils Lake, N. Dak	20	15	17	22	n. 45 w.	7
Williston, N. Dak	24	15	12	27	n. 59 w.	18
Upper Mississippi Valley.						
Minneapolis, Minn. *						
St. Paul, Minn	24	19	14	17	n. 31 w.	6
La Crosse, Wis. †	8	12	3	7	s. 45 w.	6
Madison, Wis	14	21	8	29	s. 72 w.	22
Charles City, Iowa	23	17	11	27	n. 69 w.	17
Davenport, Iowa	19	17	8	28	n. 84 w.	20
Des Moines, Iowa	16	21	9	27	s. 74 w.	19
Dubuque, Iowa	21	22	7	27	s. 87 w.	20
Keokuk, Iowa	19	22	12	23	s. 75 w.	11
Cairo, Ill	22	22	17	14	e.	3
La Salle, Ill. †	7	9	3	16	s. 81 w.	13
Peoria, Ill	17	26	7	22	s. 59 w.	18
Springfield, Ill	17	27	8	19	s. 48 w.	15
Hannibal, Mo. †	8	11	2	17	s. 79 w.	15
St. Louis, Mo	16	27	11	17	s. 29 e.	12
Missouri Valley.						
Columbia, Mo. *	7	12	9	9	s.	5
Kansas City, Mo	16	27	16	11	s. 24 e.	12
Springfield, Mo	17	26	23	6	s. 62 e.	19
Iola, Kans. †	9	11	12	4	s. 76 e.	8
Topeka, Kans. *	9	13	7	3	s. 45 e.	6
Lincoln, Nebr	17	26	15	14	s. 6 e.	6
Omaha, Nebr	20	23	13	16	s. 45 w.	4
Valentine, Nebr	22	12	21	18	n. 17 e.	10
Sioux City, Iowa †	11	7	10	10	n.	4
Pierre, S. Dak	23	10	21	19	n. 9 e.	9
Huron, S. Dak	26	14	16	19	n. 14 w.	12
Yankton, S. Dak. †	10	8	7	12	n. 68 w.	5
Northern Slope.						
Havre, Mont	17	12	22	23	n. 11 w.	11
Miles City, Mont	28	12	21	14	n. 24 e.	18
Helena, Mont	14	17	6	38	s. 85 w.	32
Kalispell, Mont	12	13	8	33	s. 88 w.	25
Rapid City, S. Dak						
Cheyenne, Wyo	27	14	7	28	n. 59 w.	59
Lander, Wyo	21	14	9	30	n. 72 w.	22
Sheridan, Wyo	21	19	13	25	n. 81 w.	12
Yellowstone Park, Wyo	15	28	5	30	s. 63 w.	28
North Platte, Nebr	19	20	22	16	s. 80 e.	6
Middle Slope.						
Denver, Colo	21	30	12	9	s. 18 e.	10
Pueblo, Colo	24	12	20	22	n. 9 w.	12
Concordia, Kans	16	23	19	11	s. 49 e.	11
Dodge, Kans	15	21	30	12	s. 72 e.	19
Wichita, Kans	16	29	20	11	s. 35 e.	16
Oklahoma, Okla	14	35	14	6	s. 21 e.	22
Southern Slope.						
Abilene, Tex	10	28	18	7	s. 31 e.	21
Amarillo, Tex	10	39	8	6	s. 4 e.	29
Del Rio, Tex †	5	5	24	2	e.	22
Roswell, N. Mex.	20	22	16	14	s. 45 e.	3
Southern Plateau.						
El Paso, Tex	19	8	29	14	n. 54 e.	19
Santa Fe, N. Mex	27	12	25	8	s. 41 w.	18
Flagstaff, Ariz	26	15	3	28	n. 66 w.	27
Phoenix, Ariz	11	12	31	18	s. 86 e.	13
Yuma, Ariz	12	22	16	24	s. 39 w.	13
Independence, Cal	16	19	16	24	s. 69 w.	8
Middle Plateau.						
Reno, Nev	8	11	10	41	s. 84 w.	31
Tonopah, Nev	8	28	24	19	s. 14 e.	21
Winnemucca, Nev	18	19	16	22	s. 80 w.	6
Modena, Utah	7	16	6	41	s. 76 w.	36
Salt Lake City, Utah	15	22	26	13	s. 62 e.	15
Durango, Colo	31	6	4	37	n. 52 w.	41
Grand Junction, Colo	10	18	24	20	s. 27 e.	9
Northern Plateau.						
Baker City, Oreg	19	29	8	18	s. 45 w.	14
Boise, Idaho	19	16	15	23	n. 69 w.	8
Lewiston, Idaho †	1	11	19	3	s. 58 e.	19
Pocatello, Idaho	6	25	20	20	s.	19
Spokane, Wash	17	25	19	13	s. 37 e.	10
Walla Walla, Wash	11	29	17	11	s. 18 e.	19
North Pacific Coast Region.						
North Head, Wash	17	27	21	11	s. 45 e.	14
Port Crescent, Wash. *	10	3	8	14	n. 41 w.	9
Seattle, Wash	17	25	18	14	s. 27 e.	9
Tacoma, Wash	23	22	6	21	n. 86 w.	15
Tatoosh Island, Wash	13	27	22	9	s. 48 e.	19
Portland, Oreg	26	17	8	22	n. 57 w.	17
Roseburg, Oreg	17	10	8	20	n. 60 w.	14
Middle Pacific Coast Region.						
Eureka, Cal	22	18	8	24	n. 76 w.	16
Mount Tamalpais, Cal	21	11	2	43	n. 76 w.	42
Red Bluff, Cal	16	29	13	19	s. 25 w.	14
Sacramento, Cal	10	38	14	9	s. 10 e.	28
San Francisco, Cal	4	9	0	52	s. 85 w.	52
San Jose, Cal. †	20	1	1	20	n. 45 w.	27
Southeast Farallon, Cal. *						
South Pacific Coast Region.						
Fresno, Cal	24	7	4	42	n. 66 w.	42
Los Angeles, Cal	15	14	16	26	n. 84 w.	10
San Diego, Cal	29	8	9	28	n. 42 w.	28
San Luis Obispo, Cal	21	9	5	31	n. 65 w.	29
West Indies						
San Juan, Porto Rico	4	20	46	0	s. 71 e.	49

* From observations at 8 p. m. only. † From observations at 8 a. m. only.

TABLE IV.—*Accumulated amounts of precipitation for each 5 minutes, for storms in which the rate of fall equaled or exceeded 0.25 in any 5 minutes, or 0.80 in 1 hour, during September, 1907, at all stations furnished with self-registering gages.*

Stations.	Date.	Total duration. From—	Total duration. To—	Total amount of precipitation.	Excessive rate. Began—	Excessive rate. Ended—	Amount before excessive began.	Depths of precipitation (in inches) during periods of time indicated. 5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
Abilene, Tex	20			0.40														0.19			
Albany, N. Y	11			0.71														0.36			
Alpena, Mich	1			0.60														0.28			
Amarillo, Tex	9	12:13 a. m.	3:45 a. m.	0.68	12:52 a. m.	1:00 a. m.	0.10	0.28	0.30												
Anniston, Ala	3	11:28 a. m.	12:50 p. m.	0.65	11:28 a. m.	11:38 a. m.	0.00	0.44	0.63												
Do	22-23	D. N. a. m.	D. N. a. m.	2.21	11:48 a. m.	12:13 p. m.	0.64	0.06	0.15	0.28	0.60	0.71									
Asheville, N. C	22	12:45 p. m.	1:25 p. m.	0.70	12:52 p. m.	1:12 p. m.	0.01	0.14	0.35	0.55	0.66										
Do	22-23	3:05 p. m.	5:20 a. m.	2.34	2:31 a. m.	3:36 a. m.	1.25	0.05	0.11	0.16	0.21	0.26	0.31	0.41	0.53	0.63	0.69	0.83	1.00		
Atlanta, Ga	22	9:27 a. m.	10:05 a. m.	0.48	9:35 a. m.	9:50 a. m.	0.01	0.15	0.33	0.44											
Atlantic City, N. J	22	5:00 p. m.	11:10 p. m.	1.72	10:29 p. m.	10:52 p. m.	1.04	0.22	0.44	0.49	0.63	0.68									
Augusta, Ga	28-29	3:25 p. m.	D. N. a. m.	1.44	12:13 a. m.	12:23 a. m.	0.84	0.30	0.43												
Baltimore, Md	22-23	12:55 p. m.	3:50 p. m.	3.58	12:56 p. m.	1:36 p. m.	1.86	0.13	0.33	0.69	0.97	1.13	1.20	1.25	1.38						
Bentonville, Ark	20			0.23														0.21			
Binghamton, N. Y	11	8:20 a. m.	11:00 a. m.	1.02	8:31 a. m.	8:51 a. m.	T.	0.28	0.49	0.65	0.75										
Birmingham, Ala	22	7:55 a. m.	12:26 p. m.	1.16	10:14 a. m.	10:48 a. m.	0.16	0.12	0.29	0.47	0.54	0.69	0.80	0.93							
Do	22	12:56 p. m.	4:27 p. m.	1.72	1:26 p. m.	2:16 p. m.	0.07	0.07	0.29	0.59	0.78	0.83	0.88	0.94	1.01	1.13	1.19				
Bismarck, N. Dak	19			0.84														0.30			
Block Island, R. I	22-23	10:27 p. m.	5:10 a. m.	1.12	3:34 a. m.	4:03 a. m.	0.26	0.05	0.13	0.33	0.49	0.71	0.77								
Boise, Idaho	1			0.12														0.06			
Boston, Mass	5	8:45 a. m.	3:10 p. m.	1.03	1:26 p. m.	2:11 p. m.	0.27	0.05	0.17	0.25	0.33	0.42	0.52	0.61	0.66	0.72					
Buffalo, N. Y	28-29			1.21														0.47			
Cairo, Ill	2			0.40														0.26			
Canton, N. Y	2	5:47 p. m.	6:15 p. m.	0.44	5:51 p. m.	6:04 p. m.	0.01	0.09	0.32	0.42											
Charles City, Iowa	17	4:45 a. m.	7:20 a. m.	1.25	4:59 a. m.	5:25 a. m.	0.02	0.20	0.58	0.76	0.83	0.88	0.91								
Charleston, S. C	29			0.65														0.60			
Charlotte, N. C	22			0.87														0.56			
Chattanooga, Tenn	22			1.79														0.43			
Cheyenne, Wyo	8			0.13				0.12													
Chicago, Ill	18			1.50														0.39			
Cincinnati, Ohio	28	4:33 p. m.	4:55 p. m.	0.29	4:33 p. m.	4:40 p. m.	0.00	0.26	0.29												
Cleveland, Ohio	17	6:43 p. m.	9:10 p. m	0.90	6:47 p. m.	7:04 p. m.	0.01	0.43	0.73	0.84											
Columbia, Mo	20			0.33														0.15			
Columbia, S. C	13	8:48 a. m.	11:45 a. m.	0.75	9:06 a. m.	9:35 a. m.	0.01	0.10	0.24	0.28	0.34	0.53	0.60								
Do	22	6:58 p. m.	7:40 p. m.	0.51	7:06 p. m.	7:16 p. m.	0.02	0.14	0.47												
Columbus, Ohio	28	1:32 p. m.	2:50 p. m.	0.37	1:33 p. m.	1:40 p. m.	0.01	0.25	0.36												
Concord, N. H	2-3	1:30 p. m.	9:12 a. m.	1.13	7:12 p. m.	7:37 p. m.	0.38	0.05	0.21	0.33	0.38	0.47									
Corpus Christi, Tex	26			0.57														0.30			
Davenport, Iowa	17	10:10 a. m.	11:20 a. m.	0.49	10:20 a. m.	10:34 a. m.	0.01	0.28	0.39	0.48											
Del Rio, Tex	21			0.06				0.02													
Denver, Colo	8			0.27														0.15			
Des Moines, Iowa	7	5:44 p. m.	7:15 p. m.	0.59	5:44 p. m.	5:54 p. m.	0.09	0.39	0.48												
Detroit, Mich	16			0.61														0.37			
Dodge, Kans	1	8:35 p. m.	9:52 p. m.	0.83	8:40 p. m.	8:57 p. m	T.	0.31	0.45	0.66	0.72										
Dubuque, Iowa	17-18			2.24														0.45			
Duluth, Minn	18	3:28 p. m.	4:20 p. m.	0.84	3:33 p. m.	4:08 p. m.	0.02	0.10	0.13	0.22	0.73	0.78									
Do	19	10:50 a. m.	9:30 p. m.	2.58	2:30 p. m.	2:43 p. m.	1.00	0.32	0.45	0.50											
Eastport, Me	5	3:50 a. m.	6:50 a. m.	0.58	6:18 a. m.	6:33 a. m.	0.09	0.09	0.28												
Elkins, W. Va	18	3:35 p. m.	8:20 p. m.	1.06	4:01 p. m.	4:29 p. m.	0.01	0.19	0.41	0.70	0.91	0.97									
Erie, Pa	28-29	6:45 p. m.	D. N. a. m.	2.65	7:15 p. m.	8:30 p. m.	0.05	0.03	0.12	0.30	0.54	0.60	0.67	0.76	0.88	0.93	0.96	1.16	1.56		
Escanaba, Mich	16			0.49														0.40			
Evansville, Ind	1	12:10 p. m.	1:50 p. m.	0.82	12:24 p. m.	12:47 p. m.	0.01	0.08	0.30	0.61	0.73	0.78									
Fort Smith, Ark	9	1:29 a. m.	12:08 p. m.	1.89	10:20 a. m.	11:00 a. m.	1.09	0.09	0.19	0.33	0.42	0.47	0.52	0.63	0.70						
Fort Worth, Tex	20			1.67														0.52			
Galveston, Tex	10	1:43 a. m.	3:10 a. m.	1.71	1:48 a. m.	2:34 a. m.	0.01	0.30	0.61	0.69	0.84	1.08	1.16	1.30	1.43	1.67	1.68				
Do	14-15	8:06 p. m.	5:49 a. m.	3.53	10:27 p. m.	11:20 p. m.	0.39	0.09	0.14	0.36	0.57	0.80	1.13	1.35	1.51	1.58	1.83	1.90			
Grand Haven, Mich	17	11:50 a. m.	3:15 p. m.	0.90	1:42 p. m.	2:00 p. m.	0.24	0.09	0.22	0.46	0.54										
Grand Rapids, Mich	1	4:50 a. m.	6:20 a. m.	0.76	5:02 a. m.	5:12 a. m.	0.03	0.32	0.72												
Do	17	12:16 p. m.	4:30 p. m.	1.97	2:40 p. m.	3:27 p. m.	0.33	0.09	0.30	0.55	0.71	0.83	0.96	1.06	1.24	1.45	1.52				
Green Bay, Wis	7-8			1.75														0.42			
Hannibal, Mo	20			0.32														0.24			
Harrisburg, Pa	10-11	6:59 p. m.	D. N. a. m.	4.68	7:48 p. m. 8:38 p. m. 9:28 p. m.	8:38 p. m. 9:28 p. m. 10:40 p. m.	0.04	0.05 1.02 1.63	0.10 1.02 1.70	0.16 1.06 1.81	0.24 1.10 1.95	0.38 1.16 2.03	0.58 1.23 2.07	0.81 1.38 2.15	1.00 1.40 2.42	1.01 1.41 2.67	1.02 1.47 2.80	.... 2.99	.... 3.64		
Hartford, Conn	4	D. N.	7:20 a. m.	1.02	12:50 a. m.	1:35 a. m.	0.07	0.05	0.16	0.32	0.40	0.41	0.48	0.56	0.69	0.75					
Do	22-23	6:20 p. m.	10:15 p. m.	4.06	4:15 p. m.	5:05 p. m.	1.87	0.10	0.16	0.29	0.37	0.40	0.51	0.60	0.74	0.88	0.99				
Hatteras, N. C	5	9:50 a. m.	11:25 a. m.	1.24	9:59 a. m.	11:11 a. m.	0.02	0.12	0.20	0.34	0.40	0.50	0.52	0.54	0.62	0.72	0.77	0.95	1.21		
Do	29	3:50 a. m.	12:40 p. m.	1.59	5:26 a. m.	6:01 a. m.	0.37	0.06	0.18	0.35	0.47	0.57	0.59	0.72							
Huron, S. Dak	16			0.28														0.16			
Indianapolis, Ind	18	3:48 p. m.	5:35 p. m.	0.55	3:55 p. m.	4:09 p. m.	0.02	0.19	0.39	0.59											
Iola, Kans	20			0.51									0.34								
Jacksonville, Fla	4	11:00 a. m.	6:45 p. m.	2.17	11:42 a. m.	12:19 p. m.	0.30	0.38	0.62	0.87	1.05	1.13	1.19	1.27							
Do	6	6:20 p. m.	8:45 p. m.	3.14	6:24 p. m.	7:14 p. m.	0.01	0.36	0.66	1.18	1.65	2.08	2.29	2.49	2.73	2.85	2.93				
Jupiter, Fla	18	1:35 p. m.	7:10 p. m.	1.63	4:50 p. m.	5:15 p. m.	0.53	0.10	0.40	0.73	0.75	0.89									
Do	28	3:30 p. m.	4:20 p. m.	0.63	3:32 p. m.	3:55 p. m.	0.01	0.18	0.20	0.37	0.51	0.58									
Kansas City, Mo	1-2			0.74														0.32			
Keokuk, Iowa	26			0.27								0.16									
Key West, Fla	14-15	7:35 p. m.	10:40 a. m.	4.76	8:08 a. m.	9:03 a. m.	2.83	0.14	0.42	0.65	0.83	0.94	0.99	1.04	1.16	1.18	1.32	1.61			
Knoxville, Tenn	17	2:15 p. m.	3:20 p. m.	0.55	2:37 p. m.	2:58 p. m.	0.01	0.09	0.21	0.39	0.46	0.48									
La Crosse, Wis	17	6:31 a. m.	8:59 a. m.	0.73	6:42 a. m.	6:58 a. m.	0.03	0.07	0.20	0.42	0.47										
La Salle, Ill	7	9:00 a. m.	10:03 a. m.	0.97	8:59 a. m.	9:15 a. m.	0.39	0.16	0.24	0.51	0.56										
Lexington, Ky	3	6:18 a. m.	2:30 p. m.	1.32	10:56 a. m.	11:46 a. m.	0.10	0.06	0.16	0.26	0.33	0.37	0.47	0.55	0.63	0.74	0.81				
Lincoln, Nebr	30			1.64														*			
Little Rock, Ark	9			1.03														0.41			
Los Angeles, Cal	2			T.				T.													
Louisville, Ky	9-10			0.84														0.51			
Lynchburg, Va	3	5:30 p. m.	7:45 p. m.	3.66	6:34 p. m.	7:34 p. m.	0.13	0.25	0.34	0.56	0.94	1.30	1.61	1.88	2.02	2.27	2.69	3.49			
Macon, Ga	3	4:55 p. m.	8:15 p. m.	1.25	5:25 p. m.	5:50 p. m.	0.01	0.06	0.19	0.47	0.71	0.79									
Madison, Wis	17	8:15 a. m.	11:00 a. m.	1.40	9:16 a. m.	9:36 a. m.	0.21	0.22	0.57	0.83	0.89										
Do	17-18	7:45 p. m.	12:40 p. m.	1.67	8:46 p. m.	9:14 p. m.	0.20	0.12	0.29	0.47	0.63	0.74	0.80								
Marquette, Mich	15-16			1.82														0.39			
Memphis, Tenn	9-10			1.42														0.55			
Meridian, Miss	21-22			1.29														0.25			
Milwaukee, Wis	17	9:35 a. m.	1:15 p. m.	1.87	11:08 a. m.	11:46 a. m.	0.12	0.13	0.47	0.96	1.31	1.41	1.46	1.53	1.59						
Minneapolis, Minn	18-19	8:22 p. m.	8:15 a. m.	2.97	2:11 a. m.	2:42 a. m.	0.67	0.10	0.21	0.32	0.39	0.49	0.54	0.57							
Mobile, Ala	22	1:25 p. m.	3:35 p. m.	0.56	1:52 p. m.	2:01 p. m.	0.03	0.16	0.30												
Montgomery, Ala	27-28	11:20 a. m.	11:30 a. m.	1.61	5:50 p. m.	6:48 p. m.	0.40	0.05	0.10	0.15	0.26	0.31	0.39	0.45	0.50	0.58	0.64	0.80			
Mount Weather, Va	4	3:00 p. m.	4:45 p. m.	1.47	3:12 p. m.	3:41 p. m.	0.02	0.15	0.42	0.64	0.88	1.05	1.10								
Nantucket, Mass	3	4:40 p. m.	7:35 p. m.	1.55	5:11 p. m.	6:16 p. m.	0.06	0.23	0.38	0.53	0.63	0.72	0.77	0.80	0.88	0.99	1.08	1.33	1.46		
Nashville, Tenn	28	2:29 p. m.	3:05 p. m.	0.71	2:22 p. m.	2:32 p. m.	0.01	0.34	0.67												
New Haven, Conn	21	6:08 p. m.	7:30 p. m.	0.64	6:10 p. m.	6:23 p. m.	0.01	0.20	0.46	0.56											
New Orleans, La	15	10:15 a. m.	5:30 p. m.	1.75	12:47 p. m.	1:05 p. m.	1.16	0.16	0.33	0.47	0.54										

TABLE IV.—*Accumulated amounts of precipitation for each 5 minutes, etc.*—Continued.

Stations.	Date.	Total duration. From—	Total duration. To—	Total amount of precipitation.	Excessive rate. Began—	Excessive rate. Ended—	Amount before excessive began.	Depths of precipitation (in inches) during periods of time indicated. 5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
New York, N. Y.	23	4:10 a. m.	8:26 a. m.	0.72	7:33 a. m.	8:03 a. m.	0.10	0.11	0.33	0.40	0.45	0.53	0.59	.....	.....	.....	.....	.....	.....	.....	.....
Norfolk, Va.	3	5:35 p. m.	7:05 p. m.	0.71	5:45 p. m.	6:09 p. m.	0.02	0.10	0.31	0.39	0.42	0.56	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do	9	4:50 p. m.	9:30 p. m.	0.73	6:27 p. m.	7:10 p. m.	0.03	0.07	0.15	0.21	0.31	0.38	0.45	0.51	0.60	0.64	.....	.....	.....	.....	.....
Northfield, Vt.	4	.....	.....	1.26	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.36	.....	.....	.....
North Head, Wash.	15	.....	.....	1.50	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.40	.....	.....	.....
Oklahoma, Okla.	9	.....	.....	1.10	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.29	.....	.....	.....
Omaha, Nebr.	7	5:25 p. m.	5:50 p. m.	0.56	5:29 p. m.	5:47 p. m.	T.	0.25	0.41	0.48	0.56	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Palestine, Tex*	17–18	.....	.....	2.52	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.00	.....	.....	.....
Parkersburg, W. Va.	10–11	7:35 p. m.	5:30 a. m.	1.57	8:11 p. m.	8:56 p. m.	0.08	0.29	0.38	0.45	0.47	0.47	0.67	0.78	0.92	1.08	.....	.....	.....	.....	.....
Do	18	12:10 a. m.	4:40 a. m.	1.20	3:08 a. m.	3:22 a. m.	0.09	0.25	0.86	1.09	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Pensacola, Fla.	10–11	11:20 p. m.	4:15 a. m.	1.50	11:49 p. m.	12:50 a. m.	0.05	0.17	0.29	0.37	0.47	0.51	0.56	0.63	0.68	0.72	0.77	0.95	.....	.....	.....
Do	27–28	9:20 p. m.	12:30 p. m.	4.53	12:08 a. m.	12:54 a. m.	0.21	0.12	0.36	0.86	1.14	1.39	1.60	1.75	1.87	1.96	.....	.....	.....	.....	.....
Peoria, Ill.	15	5:03 p. m.	6:10 p. m.	0.39	5:25 p. m.	5:37 p. m.	0.03	0.08	0.25	0.36	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do	20	D. N.	D. N.	0.65	2:47 a. m.	3:02 a. m.	0.11	0.09	0.25	0.39	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Philadelphia, Pa.	28–29	.....	.....	2.56	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.58	.....	.....	.....
Pittsburg, Pa.	2	1:45 p. m.	2:30 p. m.	0.52	2:03 p. m.	2:18 p. m.	0.05	0.17	0.35	0.44	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Portland, Me	23–24	1:00 a. m.	1:15 a. m.	3.36	9:30 p. m.	10:30 p. m.	2.06	0.18	0.29	0.48	0.59	0.71	0.86	0.93	0.98	1.09	1.13	1.22	.....	.....	.....
Portland, Oreg.	27	.....	.....	0.57	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.25	.....	.....	.....
Pueblo, Colo.	14	.....	.....	0.12	.....	.....	.....	.....	.....	0.09	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Raleigh, N. C.	23	2:55 p. m.	4:10 p. m.	1.14	2:55 p. m.	3:24 p. m.	0.00	0.19	0.40	0.65	0.82	1.06	1.12	.....	.....	.....	.....	.....	.....	.....	.....
Richmond, Va.	9	3:35 p. m.	3:49 p. m.	0.75	3:37 p. m.	3:47 p. m.	T.	0.36	0.75	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do	22	11:47 a. m.	5:58 p. m.	2.36	11:47 a. m.	12:29 p. m.	0.00	0.09	0.29	0.61	0.89	1.21	1.52	1.86	1.96	1.99	.....	.....	.....	.....	.....
Rochester, N. Y.	11	.....	.....	0.74	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.37	.....	.....	.....
Sacramento, Cal.	3	.....	.....	T.	.....	.....	.....	T.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
St. Louis, Mo	7	.....	.....	0.35	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.35	.....	.....	.....
St. Paul, Minn.	15–16	.....	.....	0.88	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.47	.....	.....	.....
Salt Lake City, Utah	4	.....	.....	0.07	.....	.....	.....	.....	.....	0.07	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
San Antonio, Tex.	16	.....	.....	0.38	.....	.....	.....	.....	.....	.....	.....	.....	0.38	.....	.....	.....	.....	.....	.....	.....	.....
San Diego, Cal.	†	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Sandusky, Ohio	10	D. N. a. m.	9:45 a. m.	1.66	5:45 a. m.	6:32 a. m.	0.33	0.06	0.18	0.29	0.40	0.82	0.94	0.95	1.01	1.13	1.16	.....	.....	.....	.....
Do	17	4:50 a. m.	6:20 a. m.	0.75	4:53 a. m.	5:39 a. m.	0.01	0.15	0.15	0.17	0.32	0.46	0.51	0.51	0.53	0.70	0.73	.....	.....	.....	.....
San Francisco, Cal.	3	.....	.....	0.11	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.06	.....	.....	.....
Savannah, Ga.	12	2:03 p. m.	3:25 p. m.	1.03	2:24 p. m.	2:49 p. m.	0.01	0.08	0.22	0.54	0.76	0.90	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do	15	8:35 a. m.	10:00 a. m.	0.62	8:39 a. m.	9:09 a. m.	0.01	0.11	0.24	0.34	0.42	0.46	0.54	.....	.....	.....	.....	.....	.....	.....	.....
Scranton, Pa	11	10:40 a. m.	3:00 p. m.	1.92	10:58 a. m.	11:28 a. m.	0.01	0.23	0.74	0.81	0.92	1.11	1.21	.....	.....	.....	.....	.....	.....	.....	.....
Seattle, Wash.	11	8:30 a. m.	D. N. p. m.	1.41	9:18 a. m.	9:51 a. m.	0.04	0.07	0.14	0.26	0.42	0.52	0.58	0.62	.....	.....	.....	.....	.....	.....	.....
Shreveport, La.	18	.....	.....	0.08	.....	.....	.....	0.04	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Spokane, Wash.	12	.....	.....	0.40	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.12	.....	.....	.....
Springfield, Ill.	20	.....	.....	0.32	.....	.....	.....	.....	.....	.....	.....	.....	0.15	.....	.....	.....	.....	.....	.....	.....	.....
Springfield, Mo.	1	4:40 p. m.	6:15 p. m.	0.77	5:06 p. m.	5:26 p. m.	0.10	0.11	0.20	0.41	0.63	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Syracuse, N. Y.	3–4	.....	.....	0.97	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.46	.....	.....	.....
Tampa, Fla	12	3:12 p. m.	4:50 p. m.	0.80	3:14 p. m.	3:29 p. m.	0.01	0.45	0.68	0.76	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do	25	3:35 p. m.	9:00 p. m.	3.42	4:25 p. m.	5:40 p. m.	0.28	0.19	0.44	0.65	0.90	1.11	1.38	1.71	1.95	2.12	2.33	2.65	2.96	.....	.....
Taylor, Tex.	10	.....	.....	0.06	.....	.....	.....	.....	.....	0.04	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Thomasville, Ga.	4	11:56 a. m.	1:38 p. m.	1.56	12:01 p. m.	12:34 p. m.	0.01	0.16	0.34	0.68	1.09	1.30	1.45	1.48	.....	.....	.....	.....	.....	.....	.....
Toledo, Ohio	28	11:00 a. m.	12:31 p. m.	1.23	11:24 a. m.	12:04 p. m.	0.05	0.12	0.55	0.72	0.85	0.94	1.02	1.05	1.13	.....	.....	.....	.....	.....	.....
Topeka, Kans.	1–2	.....	.....	0.63	.....	.....	.....	.....	.....	.....	.....	.....	0.17	.....	.....	.....	.....	.....	.....	.....	.....
Valentine, Nebr.	30	.....	.....	0.28	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.28	.....	.....	.....
Vicksburg, Miss.	9	.....	.....	0.32	.....	.....	.....	.....	.....	.....	.....	.....	0.25	.....	.....	.....	.....	.....	.....	.....	.....
Washington, D. C.	22–23	9:45 a. m.	2:45 p. m.	3.35	11:37 a. m.	1:25 p. m.	1.86	0.06	0.10	0.15	0.21	0.27	0.40	0.46	0.49	0.54	0.59	0.65	1.09	1.36	1.41
Wichita, Kans.	30–1	8:10 p. m.	D. N. a. m.	1.03	10:57 p. m.	11:22 p. m.	0.38	0.12	0.24	0.34	0.42	0.47	.....	.....	.....	.....	.....	.....	.....	.....	.....
Wytheville, Va.	21–22	D. N. p. m.	9:10 a. m.	1.63	5:26 a. m.	5:50 a. m.	0.35	0.12	0.20	0.34	0.50	0.54	.....	.....	.....	.....	.....	.....	.....	.....	.....
Yankton, S. Dak.	16–17	9:20 p. m.	D. N. a. m.	1.75	12:47 a. m.	1:56 a. m.	0.74	0.11	0.16	0.23	0.27	0.28	0.32	0.41	0.46	0.48	0.53	0.89	1.01	.....	.....
San Juan, P. R.	22	12:03 p. m.	1:15 p. m.	0.75	12:11 p. m.	12:26 p. m.	0.01	0.27	0.53	0.62	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

* Self-register not working. † No precipitation during the month.

TABLE V.—*Data furnished by the Canadian Meteorological Service, September, 1907.*

Stations.	Pressure, in inches. Actual, reduced to mean of 24 hours.	Pressure, in inches. Sea level, reduced to mean of 24 hours.	Pressure, in inches. Departure from normal.	Temperature. Mean.	Temperature. Departure from normal.	Temperature. Mean maximum.	Temperature. Mean minimum.	Precipitation. Total.	Precipitation. Departure from normal.	Precipitation. Total snowfall.
	Ins.	*Ins.*	*Ins.*	°	°	°	°	*Ins.*	*Ins.*	*Ins*
St. Johns, N. F.	29.75	29.89	—.08	52.6	— 1.4	59.2	45.9	5.06	+1.35	
Sydney, C. B. I.	29.98	30.02	+.01	56.6	+ 0.1	64.7	48.6	2.22	—1.06	
Halifax, N. S.	29.92	30.02	—.02	58.2	+ 0.6	66.1	50.2	4.26	+0.55	
Grand Manan, N. B.	29.93	29.98	—.05	57.2	+ 1.1	63.4	51.0	5.07	+1.90	
Yarmouth, N. S.	29.94	30.01	—.04	55.8	— 0.3	62.2	49.4	4.54	+1.09	
Charlottetown, P. E. I.	29.94	29.98	—.03	56.8	— 0.5	63.3	50.2	3.63	+0.23	
Chatham, N. B.	29.95	29.97	—.03	56.1	+ 0.7	65.4	46.9	4.30	+1.59	
Father Point, Que.	29.94	29.96	—.02	48.5	— 1.9	55.4	41.6	3.54	+0.41	
Quebec, Que.	29.64	29.96	—.05	53.8	— 1.3	60.0	47.7	4.62	+0.95	
Montreal, Que.	29.75	29.95	—.09	57.9	— 0.5	64.2	51.7	4.15	+0.85	
Rockliffe, Ont.	29.86	29.96	—.07	55.9	+ 0.2	64.5	47.3	3.60	+0.82	
Ottawa, Ont.	29.69	30.01	—.03	58.1	+ 0.7	65.2	51.1	3.90	+1.21	
Kingston, Ont.	29.68	29.99	—.05	60.7	+ 0.7	67.1	54.3	3.19	+0.39	
Toronto, Ont.	29.59	29.96	—.10	61.7	+ 2.7	69.4	54.0	4.80	+1.55	
White River, Ont.	.....	.....	.....	.....	.....	.....	.....	.....	.....	
Port Stanley, Ont.	29.35	29.99	—.07	60.2	+ 0.7	67.2	53.1	4.48	+1.75	
Saugeen, Ont.	29.27	29.97	—.08	59.6	+ 2.1	67.0	52.2	3.04	+0.10	
Parry Sound, Ont.	29.27	29.95	—.08	58.2	+ 2.2	67.5	48.9	2.74	—0.93	
Port Arthur, Ont.	29.24	29.95	—.08	51.3	— 0.9	59.2	43.4	3.26	—0.22	
Winnipeg, Man.	29.15	29.99	—.05	50.8	— 1.7	61.6	39.9	0.69	—1.34	
Minnedosa, Man.	28.17	30.00	+.06	47.7	— 2.8	58.8	36.6	1.39	+0.03	
Regina, Sask.	28.00	.....	.....	49.6	— 1.5	62.8	36.3	1.03	—0.30	
Medicine Hat, Alberta.	27.68	29.94	+.02	56.2	+ 1.2	68.7	43.7	1.01	—0.17	
Swift Current, Sask.	27.45	30.02	+.10	51.1	— 2.0	64.1	38.0	0.68	—0.54	
Calgary, Alberta	26.47	30.01	+.09	48.9	— 0.9	60.2	37.6	2.49	+1.13	
Banff, Alberta	25.44	30.03	+.10	46.9	+ 1.1	58.0	35.9	2.62	+0.95	
Edmonton, Alberta	27.69	29.98	+.08	49.9	+ 0.6	61.9	38.0	1.32	—0.01	
Prince Albert, Sask.	28.39	29.95	+.05	46.0	— 2.4	56.3	35.7	1.08	—0.20	
Battleford, Sask.	28.25	29.98	+.08	50.0	— 1.8	62.3	37.7	2.13	+0.88	
Kamloops, B. C.	.....	.....	.....	.....	.....	.....	.....	.....	.....	
Victoria, B. C.	.....	.....	.....	.....	.....	.....	.....	.....	.....	
Barkerville, B. C.	.....	.....	.....	.....	.....	.....	.....	.....	.....	
Hamilton, Bermuda	29.99	30.15	+.08	77.1	— 0.3	82.9	71.4	3.34	—3.17	
Dawson, Yukon	.....	.....	.....	.....	.....	.....	.....	.....	.....	

TABLE VI.—*Heights of rivers referred to zeros of gages, September, 1907.*

Stations.	Distance to mouth of river.	Flood stage on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Yellowstone River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Billings, Mont.	330	8	2.8	1-5, 8-12	2.0	25-27	2.5	0.8
James River.								
Huron, S. Dak.	139	9	— 0.1	1-4, 17	— 0.3	11-14	—0.2	0.2
Republican River.								
Clay Center, Kans.	42	18	5.2	2, 3	4.8	26-30	5.0	0.4
Smoky Hill-Kansas River.								
Abilene, Kans.	254	22	1.0	21	0.0	17, 19, 26-30	0.3	1.0
Manhattan, Kans.	160	18	3.1	6	2.4	21, 27	2.7	0.7
Topeka, Kans.	87	21	5.8	6, 7	4.9	21-23	5.3	0.9
Missouri River.								
Townsend, Mont.	2,504	11	4.7	8	4.4	25-30	4.5	0.3
Fort Benton, Mont.	2,285	12	2.3	6, 7, 15, 16	1.8	25-30	2.1	0.5
Wolfpoint, Mont.	1,952	17	0.1	7	— 0.3	27-30	—0.2	0.6
Bismarck, N. Dak.	1,309	14	3.8	4, 5	2.5	26, 27	3.1	1.3
Pierre, S. Dak.	1,114	14	3.5	1-5, 7	1.6	18, 19, 29, 30	2.4	1.9
Sioux City, Iowa	784	17	7.6	1	6.5	25-30	6.9	1.1
Blair, Nebr.	705	15	8.1	1	6.7	29, 30	7.2	1.4
Omaha, Nebr.	669	18	10.5	1	8.6	29, 30	9.4	1.9
St. Joseph, Mo	481	10	4.2	2	1.8	28	2.6	2.4
Kansas City, Mo.	388	21	11.2	3	8.0	17	9.0	3.2
Glasgow, Mo.	231	18	8.1	5	5.7	21, 30	6.6	2.4
Boonville, Mo.	199	20	10.2	5	8.2	23, 29, 30	9.0	2.0
Hermann, Mo.	103	24	9.0	1	6.7	30	7.7	2.3
Minnesota River.								
Mankato, Minn.	127	18	5.4	22	2.6	16	3.7	2.8
St. Croix River.								
Stillwater, Minn.	23	11	7.9	26	3.6	14-16	5.3	4.3
Illinois River.								
La Salle, Ill.	197	18	19.4	30	14.3	18	15.8	5.1
Peoria, Ill.	135	14	12.6	30	11.0	20	11.9	1.6
Conemaugh River.								
Johnstown, Pa.	64	7	3.9	11	1.4	20-23, 28-30	1.8	2.5
Allegheny River.								
Warren, Pa.	177	14	0.1	12-14	— 0.6	8-10	—0.2	0.7
Parker, Pa.	73	20	1.5	13	0.0	1-3	0.6	1.5
Freeport, Pa.	29	20	6.5	12	1.2	2	2.9	5.3
Youghiogheny River.								
Confluence, Pa.	59	10	1.6	12	0.4	2, 27-29	0.7	1.2
West Newton, Pa.	15	23	2.9	12	0.3	2, 3	1.1	2.6
Monongahela River.								
Fairmont, W. Va.	119	25	16.5	12	13.5	18	14.8	3.0
Greensboro, Pa.	81	18	9.2	12	7.1	30	7.8	2.1
Lock No. 4, Pa.	40	28	10.5	12	6.7	30	7.6	3.8
Muskingum River.								
Zanesville, Ohio	70	25	10.0	19	7.8	28	8.3	2.2
Little Kanawha River.								
Creston, W. Va.	38	20	11.5	11	2.3	19	3.6	9.2
New-Great Kanawha River.								
Hinton, W. Va.	153	14	10.0	24	1.2	4, 5	2.3	8.8
Charleston, W. Va.	58	30	11.8	25	4.3	29	7.0	7.5
Scioto River.								
Columbus, Ohio	110	17	2.8	29	1.4	6-17	1.8	1.4
Licking River.								
Falmouth, Ky.	30	25	5.0	4, 13	1.0	29	2.8	4.0
Kentucky River.								
Beattyville, Ky	254	30	4.0	11	0.2	24-28	1.3	3.8
Frankfort, Ky.	65	31	8.7	13	5.5	2, 24	6.5	3.2
Wabash River.								
Mount Carmel, Ill.	75	15	4.8	5, 6	2.0	30	3.2	2.8
Cumberland River.								
Burnside, Ky.	518	50	18.0	12	0.3	2, 3	3.3	17.7
Celina, Tenn.	383	45	13.6	14	1.7	2, 3, 6	4.8	11.9
Carthage, Tenn.	308	40	8.8	14	1.6	7	3.5	7.2
Nashville, Tenn.	193	40	12.6	16	7.7	9	9.2	4.9
Clarksville, Tenn.	126	43	11.4	17	2.7	3	5.4	8.7
Clinch River.								
Speers Ferry, Va.	156	20	1.7	23, 24	0.0	1, 2, 17, 18, 21	0.5	1.7
Clinton, Tenn.	52	25	9.0	24	3.7	1, 2, 21	5.6	5.3
South Fork Holston River.								
Bluff City, Tenn.	35	12	6.2	24	0.9	7, 17-19, 21	1.7	5.3
Holston River.								
Rogersville, Tenn.	103	14	9.0	24	1.8	2, 19-21	2.8	7.2
French Broad River.								
Asheville, N. C.	144	4	2.0	24	— 0.7	16, 20, 21	—0.3	2.7
Dandridge, Tenn.	46	12	6.6	24	0.5	17, 21	1.3	6.1
Tennessee River.								
Knoxville, Tenn.	635	12	10.5	25	0.8	21	2.3	9.7
Loudon, Tenn.	590	25	7.8	25	1.1	2, 16, 17, 20, 21	2.3	6.7
Kingston, Tenn.	556	25	7.3	25	1.3	21	2.7	6.0
Chattanooga, Tenn.	452	33	10.6	26	2.1	5, 6	4.2	8.5
Bridgeport, Ala.	402	24	8.3	26	1.2	3, 4, 7, 8, 22	2.7	7.1
Guntersville, Ala.	349	31	12.1	27	2.8	8	5.1	9.3
Florence, Ala.	255	16	6.8	27, 28	0.7	8	2.2	6.1
Riverton, Ala.	225	26	10.7	28	2.5	8	4.4	8.2
Johnsonville, Tenn.	95	21	9.3	30	2.5	6, 9, 10	3.8	6.8
Ohio River.								
Pittsburg, Pa.	966	22	7.0	12	2.8	15	5.7	4.2
Dam No. 2, Pa.	956	25	7.8	12	0.9	3	3.3	6.9
Beaver Dam, Pa.	925	27	10.2	12	2.8	1	5.5	7.4
Wheeling, W. Va.	875	36	9.3	13	2.9	2	5.1	6.4
Parkersburg, W. Va.	785	36	11.2	12	4.2	3	6.8	7.0
Point Pleasant, W. Va.	706	39	12.5	13	3.4	3	6.2	9.1
Huntington, W. Va.	660	50	16.4	13	6.8	3	9.9	9.6
Catlettsburg, Ky.	651	50	15.8	13	5.8	3	9.2	10.0
Portsmouth, Ohio	612	50	15.8	14	7.2	3	10.1	8.6
Maysville, Ky.	559	50	15.2	14	7.4	4	10.2	7.8
Cincinnati, Ohio.	499	50	16.8	15	9.9	10	12.1	6.9
Madison, Ind.	413	46	14.2	16	9.0	6, 10, 23, 24	10.8	5.2
Louisville, Ky.	367	28	7.0	16, 17	4.6	24	5.5	2.4
Evansville, Ind.	184	35	13.7	1	6.9	27	9.6	6.8

Stations.	Distance to mouth of river.	Flood stage on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Ohio River—Cont'd.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Mount Vernon, Ind.	148	35	13.2	1	6.4	28	9.2	6.8
Paducah, Ky.	47	40	10.4	2	6.8	26	8.1	3.6
Cairo, Ill.	1	45	19.8	2, 3	13.2	26	16.0	6.6
Neosho River.								
Iola, Kans.	262	10	— 0.3	1, 5	— 1.5	26, 30	—0.9	1.2
Oswego, Kans.	184	20	0.6	1	0.0	23-30	0.2	0.6
Fort Gibson, Ind. T.	3	22	10.0	1	8.7	19-30	9.0	1.3
Canadian River.								
Calvin, Ind. T.	99	10	3.6	19	1.7	28-30	2.8	1.9
Black River.								
Blackrock, Ark.	67	12	4.9	4	2.4	24-30	2.9	2.5
White River.								
Calicorock, Ark	272	18	0.7	3	— 0.4	22, 23	0.0	1.1
Batesville, Ark.	217	18	2.9	4	1.6	21-24	1.9	1.3
Clarendon, Ark.	75	30	10.3	1	7.7	28	8.9	2.6
Arkansas River.								
Wichita, Kans.	832	10	— 1.0	1	— 1.7	26-29	—1.4	0.7
Tulsa, Ind. T.	551	16	3.5	1	2.2	30	2.7	1.3
Webbers Falls, Ind. T.	465	23	5.4	1, 2	2.6	22-30	3.5	2.8
Fort Smith, Ark.	403	22	4.5	1	1.8	29, 30	2.5	2.7
Dardanelle, Ark.	256	21	5.2	1	1.0	17-19	2.1	4.2
Little Rock, Ark.	176	23	6.5	2	2.4	30	3.2	4.1
Pine Bluff, Ark.	121	25	9.1	3	4.9	30	6.1	4.2
Yazoo River.								
Greenwood, Miss.	175	38	3.3	2, 3	1.9	25, 26	2.4	1.4
Yazoo City, Miss.	80	25	0.5	3, 4	— 1.6	30	—0.5	2.1
Ouachita River.								
Camden, Ark.	304	39	9.0	11	3.5	30	4.8	5.5
Monroe, La.	122	40	8.8	19	1.8	12	4.4	7.0
Red River								
Denison, Tex. (4)	768	22	1.7	23	0.6	29	1.0	1.1
Arthur City, Tex.	688	27	7.8	1	5.7	23	6.3	2.1
Fulton, Ark.	515	28	8.0	5, 6	6.5	30	7.2	1.5
Shreveport, La.	327	29	0.3	1-3	— 1.6	30	—0.7	1.9
Alexandria, La.	118	33	3.7	1	1.7	30	2.7	2.0
Mississippi River.								
Fort Ripley, Minn.	2,082	10	5.9	24	4.3	9	5.0	1.6
St. Paul, Minn.	1,954	14	6.3	25, 26	3.6	13-16	4.7	2.7
Red Wing, Minn.	1,914	14	6.3	26, 27	1.9	15-17	3.5	4.4
Reeds Landing, Minn.	1,884	12	6.4	25	1.8	17, 18	3.6	4.6
La Crosse, Wis.	1,819	12	7.4	27-29	2.8	17	4.6	4.6
Prairie du Chien, Wis.	1,759	18	8.1	30	3.3	16, 17	4.9	4.8
Dubuque, Iowa.	1,699	15	8.4	30	3.6	17	5.4	4.8
Leclaire, Iowa.	1,609	10	5.9	30	2.0	17	3.4	3.9
Davenport, Iowa.	1,593	15	7.6	30	3.5	17	5.7	4.1
Muscatine, Iowa	1,562	16	8.6	30	4.4	17, 18	5.9	4.2
Galland, Iowa.	1,472	8	3.8	1, 2	1.8	20	2.7	2.0
Keokuk, Iowa.	1,463	15	6.7	2	3.1	19, 20	4.8	3.6
Warsaw, Ill.	1,458	18	9.7	2	6.0	20	7.7	3.7
Hannibal, Mo	1,402	13	7.6	3, 4	3.9	20	5.6	3.7
Grafton, Ill	1,306	23	11.0	4, 5	7.1	22, 23	8.8	3.9
St. Louis, Mo	1,264	30	14.0	1	7.9	22	10.7	6.1
Chester, Ill	1,189	30	11.9	1	7.0	23	9.2	4.9
New Madrid, Mo.	1,008	34	16.2	3	10.9	26, 27	13.2	5.3
Luxora, Ark	905	33	9.4	1, 2	4.8	28-30	6.9	4.6
Memphis, Tenn	843	33	14.4	1	9.2	28-30	11.6	5.2
Helena, Ark.	767	42	19.1	1	12.2	30	15.3	6.9
Arkansas City, Ark.	635	42	22.1	1	13.5	30	17.7	8.6
Greenville, Miss.	595	42	17.9	1	11.1	30	14.4	6.8
Vicksburg, Miss.	474	45	19.4	1-3	11.6	30	15.6	7.8
Natchez, Miss.	373	46	20.4	2	13.5	30	17.1	6.9
Baton Rouge, La.	240	35	12.2	4	7.3	27	10.1	4.9
Donaldsonville, La.	188	28	8.6	2-4	5.7	26, 27, 30	7.3	2.9
New Orleans, La.	108	16	6.2	16	4.8	25, 26	5.6	1.4
Atchafalaya River.								
Simmesport, La.	127	33	14.4	2-4	7.5	30	11.4	6.9
Melville, La.	103	31	18.3	4	11.7	30	15.4	6.6
Hudson River.								
Albany, N. Y.	147	12	4.6	24, 25	1.2	1, 2	3.2	3.4
Delaware River.								
Hancock (E. Branch), N. Y.	287	12	4.1	12	2.2	1, 2	2.8	1.9
Hancock (W. Branch), N. Y.	287	10	4.9	12	2.3	1, 2	3.3	2.6
Port Jervis, N. Y.	215	14	2.0	13	— 0.1	6, 9	0.6	2.1
Phillipsburg, N. J.	146	26	4.7	24	— 0.2	2	1.4	4.9
Trenton, N. J.	92	18	5.5	24	0.3	4-5	1.9	5.2
North Branch Susquehanna.								
Binghamton, N. Y.	183	16	6.4	12	1.5	1	2.7	4.9
Towanda, Pa	139	16	4.0	13	0.2	1-4	1.3	3.8
Wilkes-Barre, Pa.	60	17	7.4	13, 14	2.2	1-3	4.0	5.2
West Branch Susquehanna.								
Williamsport, Pa.	39	20	2.3	12	0.4	1-4	1.0	1.9
Susquehanna River.								
Harrisburg, Pa.	69	17	4.1	13	0.5	2	2.1	3.6
Shenandoah River.								
Riverton, Va.	58	22	8.6	24	— 1.2	10	0.0	9.8
Potomac River.								
Cumberland Md	290	8	3.1	11	2.0	2, 3	2.3	1.1
Harpers Ferry, W. Va.	172	18	8.5	25	0.0	3	1.9	8.5
James River.								
Buchanan, Va.	305	12	8.4	24	2.0	1-4	3.1	6.4
Lynchburg, Va.	260	18	9.2	24	1.3	3, 17, 18	2.1	7.9
Columbia, Va.	167	18	24.1	24	2.5	3	5.2	21.6
Richmond, Va.	111	10	12.3	25	— 0.2	2-4, 20	0.9	12.5
Roanoke River.								
Clarksville, Va.	196	12	6.5	25	— 0.4	2, 3, 11	0.3	6.9
Weldon, N. C.	129	30	25.3	26	9.0	4	10.7	16.3
Tar River.								
Greenville, N. C.	21	22	5.6	29	2.8	24	3.8	2.8
Cape Fear River.								
Fayetteville, N. C.	112	38	23.4	5	1.9	22	5.5	21.5
Pedee River.								
Cheraw, S. C.	149	27	14.7	26	1.4	22, 23	3.3	13.3
Smiths Mills, S. C.	51	16	9.9	30	1.4	25	3.4	8.5

TABLE VI.—*Heights of rivers referred to zeros of gages*—Continued.

Stations.	Distance to mouth of river.	Flood stage on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Lynch Creek.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Effingham, S. C.	35	12	5.2	17	3.3	24-26	4.1	1.9
Black River.								
Kingstree, S. C.	45	12	9.0	1	2.5	13,14,26,27	5.2	6.5
Catawba-Wateree River.								
Mount Holly, N. C.	143	15	7.0	24	1.8	1-10,14-22	2.2	5.2
Catawba, S. C.	107	11	7.5	25	1.6	19,23	2.5	5.9
Camden, S. C.	37	14	20.5	25	3.5	22	6.7	17.0
Congaree River.								
Columbia, S. C.	52	15	4.7	25	0.0	22	1.2	4.7
Savannah River.								
Calhoun Falls, S. C.	347	15	5.0	23	2.5	2,3,18-20	3.1	2.5
Augusta, Ga.	268	32	15.8	25	5.6	3,4,17,21	7.7	10.2
Oconee River.								
Dublin, Ga.	79	30	6.0	30	— 1.2	22,23	0.5	7.2
Ocmulgee River.								
Macon, Ga.	203	18	12.1	29	0.1	3	2.4	12.0
Flint River.								
Montezuma, Ga.	152	20	3.3	30	1.0	4	2.0	2.3
Albany, Ga.	90	20	9.1	30	0.5	4	1.5	8.6
Bainbridge, Ga.	29	22	7.7	30	3.1	23	3.8	4.6
Chattahoochee River.								
West Point, Ga.	239	20	5.2	26	1.6	1,21	2.4	3.6
Eufaula, Ala.	90	40	5.9	29	0.2	23	1.9	5.7
Alaga, Ala.	80	25	13.7	29	1.9	22	3.8	11.8
Coosa River.								
Rome, Ga.	266	30	9.5	23	0.6	20,21	2.3	8.9
Gadsden, Ala.	162	22	8.2	26	0.5	19-22	2.4	7.7
Lock No. 4, Ala.	113	17	8.7	24	0.4	19-21	2.3	8.3
Wetumpka, Ala.	12	45	11.5	25	1.6	22	4.3	9.9
Alabama River.								
Montgomery, Ala.	323	35	8.0	24	0.9	3,22,23	2.2	7.1
Selma, Ala.	246	35	8.6	27	0.1	22,23	2.4	8.5
Black Warrior River.								
Tuscaloosa, Ala.	90	43	15.7	13	4.7	1-3,5	7.4	11.0
Tombigbee River.								
Columbus, Miss.	316	33	— 1.5	26	— 3.1	13-23	—2.8	1.6
Demopolis, Ala.	168	35	6.5	11	— 1.6	4-7	1.3	8.1
Pascagoula River.								
Merrill, Miss.	78	20	12.0	23	2.6	8	5.7	9.4
Pearl River.								
Columbia, Miss.	110	14	5.2	4	3.7	28-30	4.2	1.5
Sabine River.								
Logansport, La.	315	25	0.8	1,6	0.1	27, 29, 30	0.5	0.7
Neches River.								
Beaumont, Tex.	18	10	2.0	27	0.2	11	1.3	1.8
Trinity River.								
Dallas, Tex.	320	25	3.5	1	2.8	20-22	3.0	0.7
Liberty, Tex.	20	25	8.6	30	3.5	6	4.9	5.1
Brazos River.								
Waco, Tex.	285	22	3.1	1	2.9	11-17,22,26	3.0	0.2
Hempstead, Tex.	140	40	1.0	24	— 2.9	22	—1.8	3.9
Booth, Tex.	61	39	3.5	21-30	3.3	1-8	3.4	0.2
Colorado River.								
Austin, Tex.	214	18	1.8	26,27	0.5	{8,9,13,14,17-20}[1]	0.8	1.3
Columbus, Tex.	98	24	5.9	9,10	5.1	30	5.5	0.8
Rio Grande.								
San Marcial, N. Mex.	1,233	11	12.0	1	8.9	26	9.7	3.1
El Paso, Tex.	1,030	14	13.8	3	9.5	17,19	10.7	4.3
Red River of the North.								
Moorhead, Minn.	284	26	8.4	23,24	7.7	13,14	8.0	0.7
Snake River.								
Lewiston, Idaho.	144	24	2.3	8	1.4	24-26	1.8	0.9
Columbia River.								
Wenatchee, Wash.	473	40	17.0	1	11.8	30	14.7	5.2
Umatilla, Oreg.	270	25	7.7	2-5	5.3	30	6.7	2.4
The Dalles, Oreg.	166	40	10.9	2,3	7.4	30	9.6	3.5
Willamette River.								
Portland, Oreg.	12	15	5.8	7-10	2.8	30	4.9	3.0
Sacramento River.								
Red Bluff, Cal.	265	23	1.2	1-6	0.9	26-30	1.1	0.3
Sacramento, Cal.	64	25	8.5	6	7.5	27	8.0	1.0

[1] 4 days missing.

Honolulu, T. H., latitude 21° 19′ north, longitude 157° 30′ west; barometer above sea, 38 feet; gravity correction, —0.057 inch, applied. September, 1907.

Day.	Pressure.*		Air temperature.				Moisture.				Wind.				Precipitation.		Clouds.					
							8 a. m.		8 p. m.		8 a. m.		8 p. m.				8 a. m.			8 p. m.		
	8 a. m.	8 p. m.	8 a. m.	8 p. m.	Maximum.	Minimum.	Wet.	Relative humidity.	Wet.	Relative humidity.	Direction.	Velocity.	Direction.	Velocity.	8 a. m.	8 p. m.	Amount.	Kind.	Direction.	Amount.	Kind.	Direction.
1	29.92	29.89	77.5	77.0	85	74	71.0	72	71.0	74	w.	3	ne.	3	0.00	0.00	9	S.	s.	Few	S.-cu.	ne.
2	29.89	29.89	78.0	77.5	82	72	72.0	75	73.0	81	w.	3	n.	4	0.00	0.00	1	Cu.	s.	1	A.-s.	nw.
3	29.93	29.91	79.0	77.5	85	72	71.3	69	73.0	81	se.	1	ne.	6	0.00	0.00	2	A.-s.	0	1	A.-s.	nw.
4	29.96	29.98	81.2	79.0	85	73	73.0	68	71.0	69	se.	3	ne.	9	0.00	0.00	2	Ci.	0	4	S.	ne.
5	29.98	29.98	78.5	78.0	82	74	71.0	69	69.0	63	e.	4	e.	7	0.01	T.	6 3	Ci.-s. Cu.	w. e.	Few	Cu.	e.
6	29.96	29.94	79.5	76.0	84	71	69.0	58	68.0	66	ne.	7	ne.	8	0.00	T.	1	Cu.	e.	0	0	0
7	29.94	29.94	79.0	77.0	84	72	69.5	58	69.0	67	e.	12	e.	5	0.01	0.00	4	Cu.	e.	0	0	0
8	29.93	29.94	79.6	78.0	83	75	69.2	59	68.0	60	ne.	5	ne.	15	0.00	0.00	3 1	Ci.-cu. Cu.	0 e.	1	S.	e.
9	29.94	29.92	79.0	77.0	83	74	69.5	62	70.0	71	ne.	8	ne.	5	0.00	T.	9 1	Ci.-s. Cu.	0 e.	3	A.-s.	0
10	29.95	29.91	77.4	76.6	83	74	69.6	69	73.0	84	ne.	9	ne.	2	0.00	0.02	5 2	Ci. Cu.	w. 0	10	S.	e.
11	29.92	29.91	79.0	78.0	83	72	73.0	75	72.5	77	e.	8	ne.	1	0.10	T.	5	Cu.	e.	Few	Cu.	e.
12	29.94	29.94	78.0	79.0	86	74	72.5	77	73.0	75	w.	5	e.	3	0.00	T.	8 1	Ci. Cu.	w. e.	Few	Cu.	e.
13	29.96	29.95	79.5	78.0	85	75	71.0	66	71.0	71	e.	9	e.	15	0.00	0.00	3	Cu.	e.	Few	Cu.	ne.
14	29.97	29.94	80.0	77.5	83	75	71.0	64	69.5	67	ne.	6	ne.	8	0.00	0.00	5	Cu.	e.	7	Cu.	ne.
15	29.94	29.94	79.0	77.0	84	75	69.0	60	70.0	71	ne.	7	ne.	12	0.00	0.00	1	Ci.-cu.	0	1	Cu.	ne.
16	29.94	29.94	80.0	77.0	84	74	69.5	59	71.0	74	ne.	4	ne.	3	0.00	0.00	Few	Cu.	e.	5	Cu.	ne.
17	29.94	29.92	79.3	77.0	84	73	70.2	64	71.0	74	sw.	5	ne.	5	0.00	0.00	5	Ci.	w.	4 2	Ci. Cu.	w. ne.
18	29.90	29.88	77.0	76.0	82	72	72.0	79	67.0	62	s.	6	e.	5	0.00	0.00	9	S.-cu.	e.	Few	A.-s.	w.
19	29.91	29.92	79.2	79.0	83	73	73.2	75	72.0	71	se.	8	ne.	12	0.00	0.00	3	Cu.	e.	10	A.-s.	sw.
20	29.95	29.92	79.4	78.0	82	75	71.0	66	71.0	71	ne.	14	ne.	14	T.	0.00	7 2	A.-cu. Cu.	e. e.	10	A.-s.	w.
21	29.93	29.90	78.0	76.0	83	74	69.0	63	70.5	76	ne.	12	e.	10	T.	0.01	5 4	A.-s. Cu.	w. e.	4 3 3	Ci. A.-s. Cu.	w. nw. e.
22	29.88	29.87	78.5	78.0	81	74	69.0	62	71.5	73	ne.	14	ne.	16	0.01	0.01	2 2	Ci.-s. Cu.	w. ne.	2 8	A.-cu. A.-s.	n. se.
23	29.89	29.88	80.0	77.5	84	75	73.0	72	71.0	72	n.	7	se.	4	T.	T.	3 4	Ci. A.-cu.	w. 0	1 1	A.-s. Cu.	nw. se.
24	29.89	29.90	78.2	78.5	82	74	75.2	87	75.5	87	n.	4	se.	3	T.	T.	6 2 1 6	A.-s. Cu.-n. A.-cu. Cu.	0 e. s. sw.	9 1	S. S.	se. ne.
25	29.94	29.94	79.0	78.0	83	75	75.5	85	74.0	83	se.	2	ne.	3	0.04	T.						
26	30.02	30.03	81.0	79.0	86	74	74.0	72	72.0	71	ne.	6	ne.	15	0.08	0.00	2 4	Cl. A.-s.	0 0	1	A.-s.	0
27	30.07	30.06	78.2	77.0	84	76	70.0	66	69.0	67	ne.	12	e.	9	0.00	0.00	6 1	A.-cu. Cu.	w. e.	Few	A.-s.	0
28	30.06	30.04	79.0	76.0	83	74	69.0	60	70.0	74	ne.	12	ne.	3	0.01	0.00	1	Cu.	e.	2	Cu.	ne.
29	30.06	30.06	79.0	77.0	84	73	68.8	59	70.0	71	e.	11	ne.	8	T.	0.00	3	Cu.	e.	3	Cu.	e.
30	30.09	30.07	78.7	77.0	83	75	74.0	80	69.0	67	e.	8	ne.	9	0.00	T.	2	Cu.	e.	2	A.-s.	0
31																						
Mean....	29.953	29.944	79.0	77.5	83.5	73.8	71.2	68.3	70.8	72.3	ne.	7.1	ne.	7.3	0.26	0.04	5.1	Cu.	e.	3.3	A.-s.	ne.

Observations are made at 8 a.m. and 8 p. m., local standard time, which is that of 157° 30′ west, and is 5h and 30m slower than 75th meridian time. *Pressure values are reduced to sea level and standard gravity.

Chart I. Hydrographs for Seven Principal Rivers of the United States, September, 1907.

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Chart II. Tracks of Centers of High Areas, September, 1907.

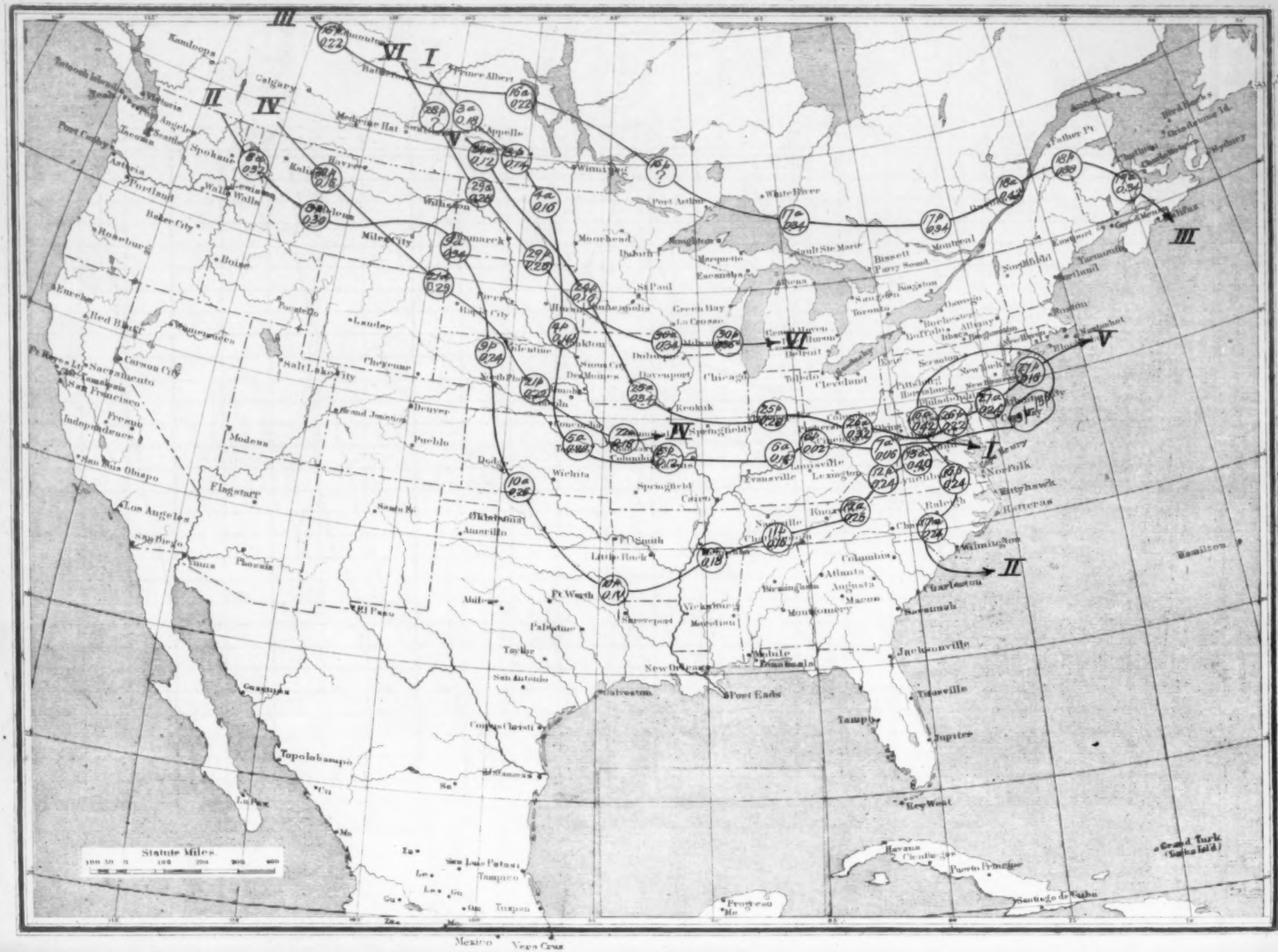

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Chart III. Tracks of Centers of Low Areas, September, 1907.

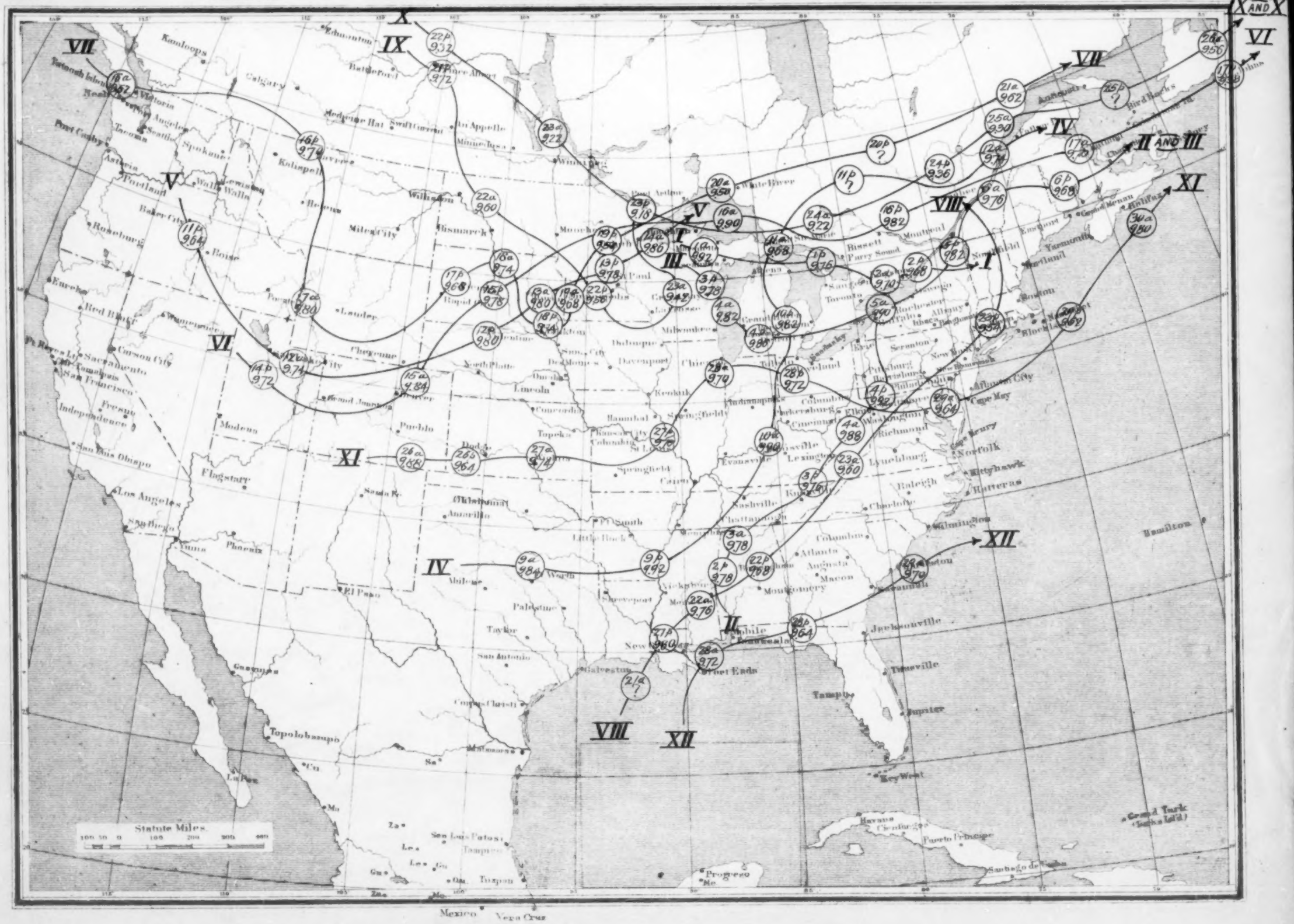

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Chart IV. Total Precipitation, September, 1907.

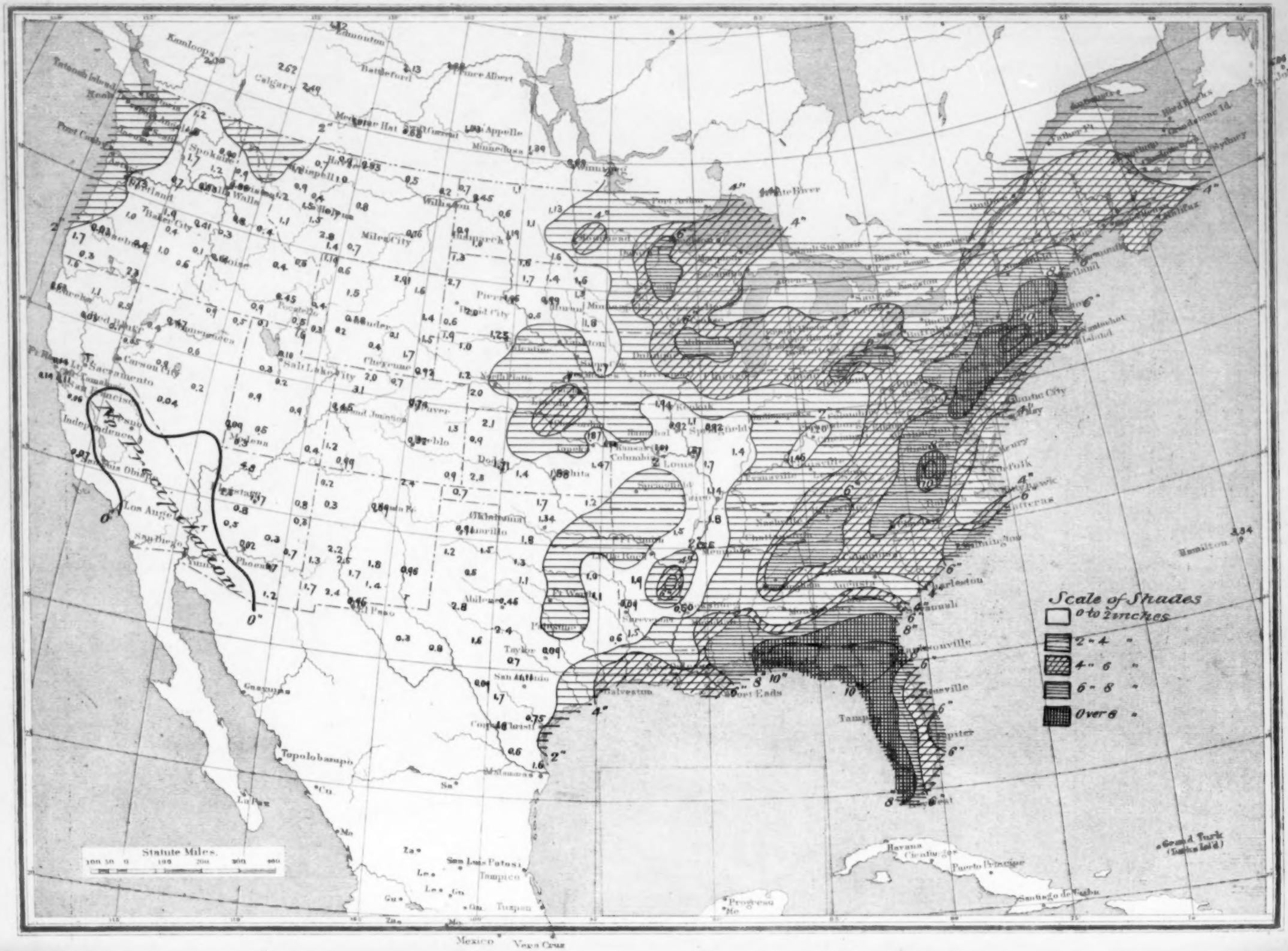

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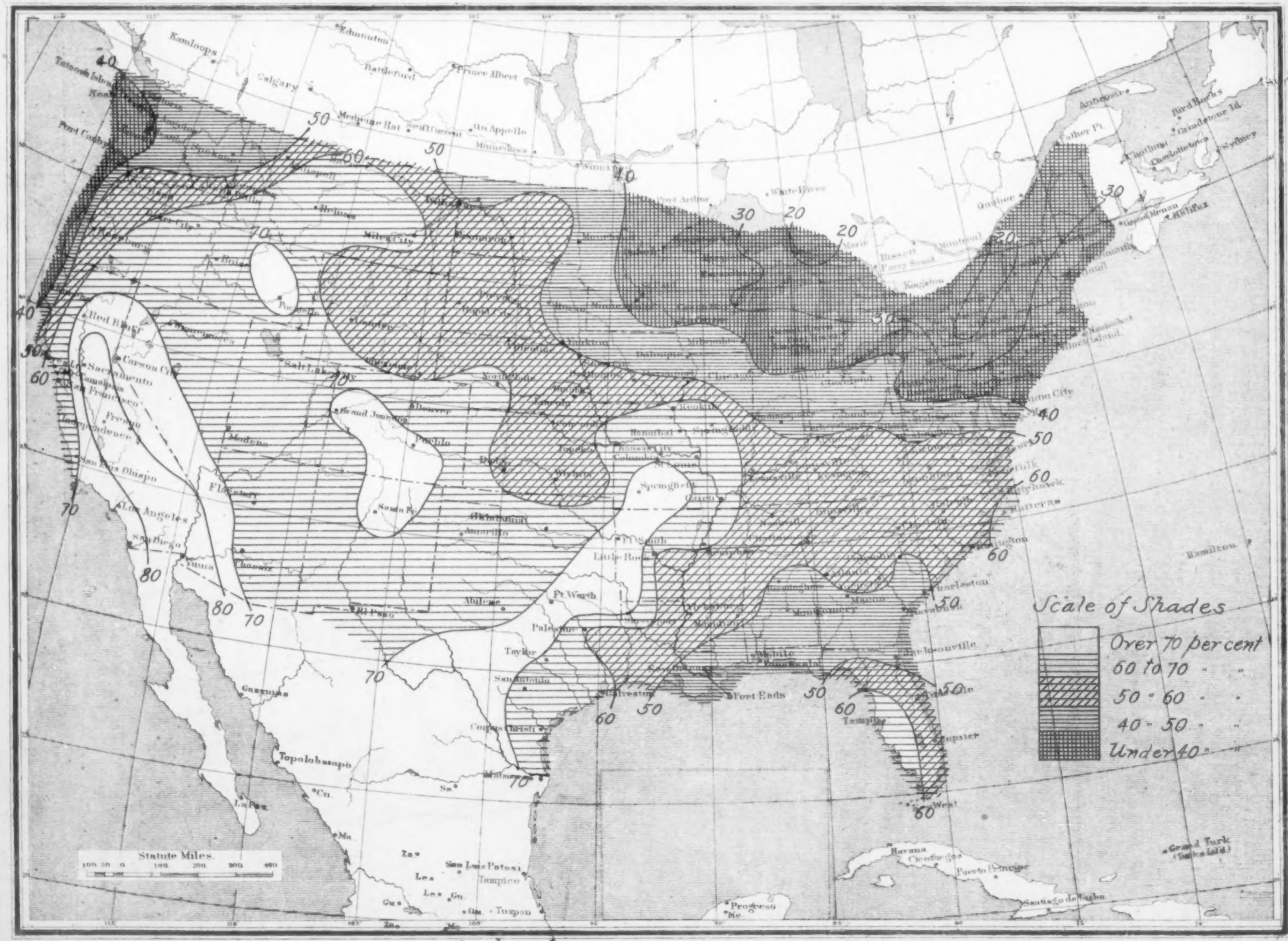
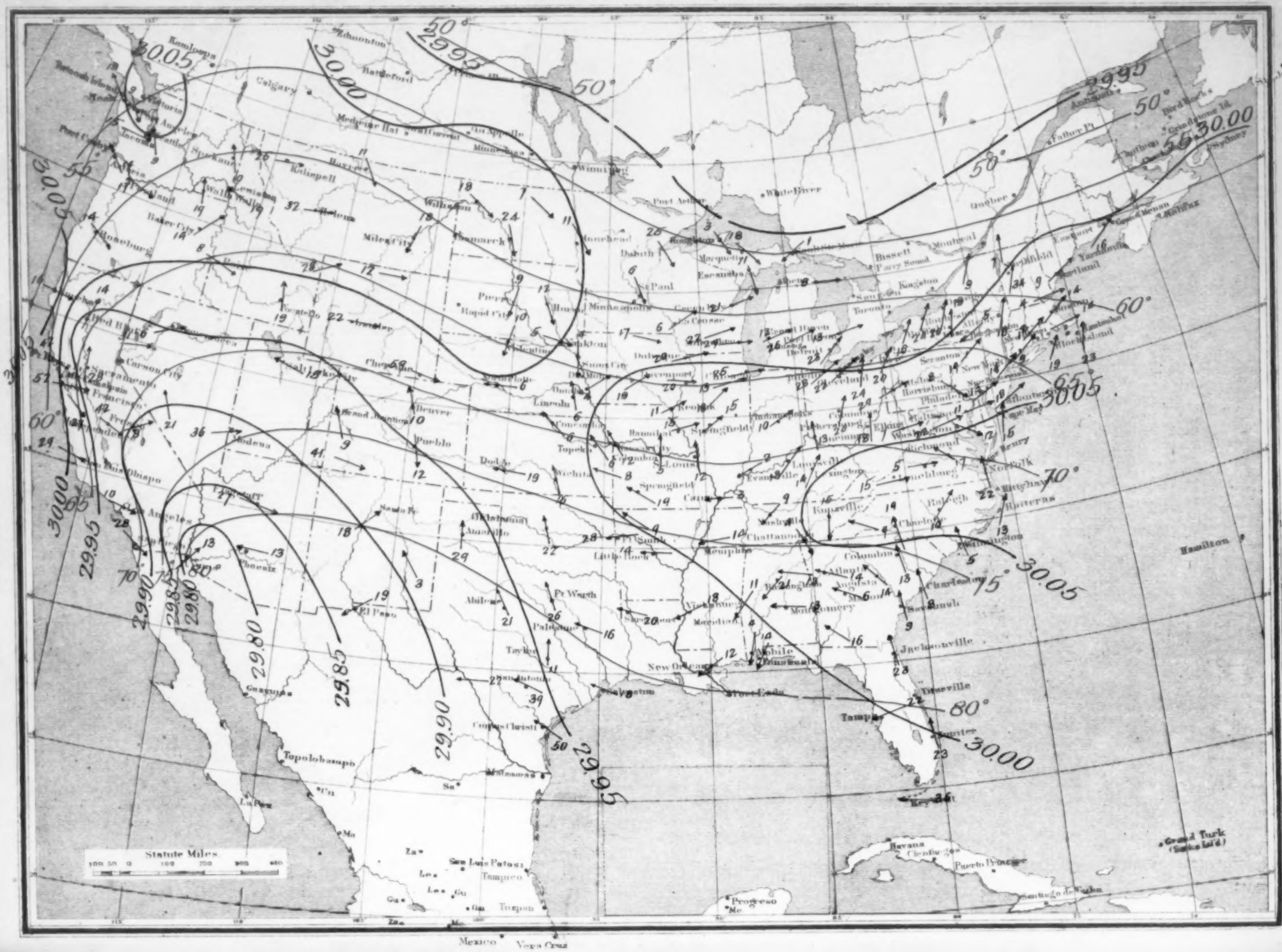
Chart V. Percentage of Clear Sky between Sunrise and Sunset, September, 1907.



• Barkerville **Chart VI. Isobars and Isotherms at Sea Level; Surface Wind Resultants, September, 1907.**